form•Z Free Manual
TWENTIETH EDITION
August 2015

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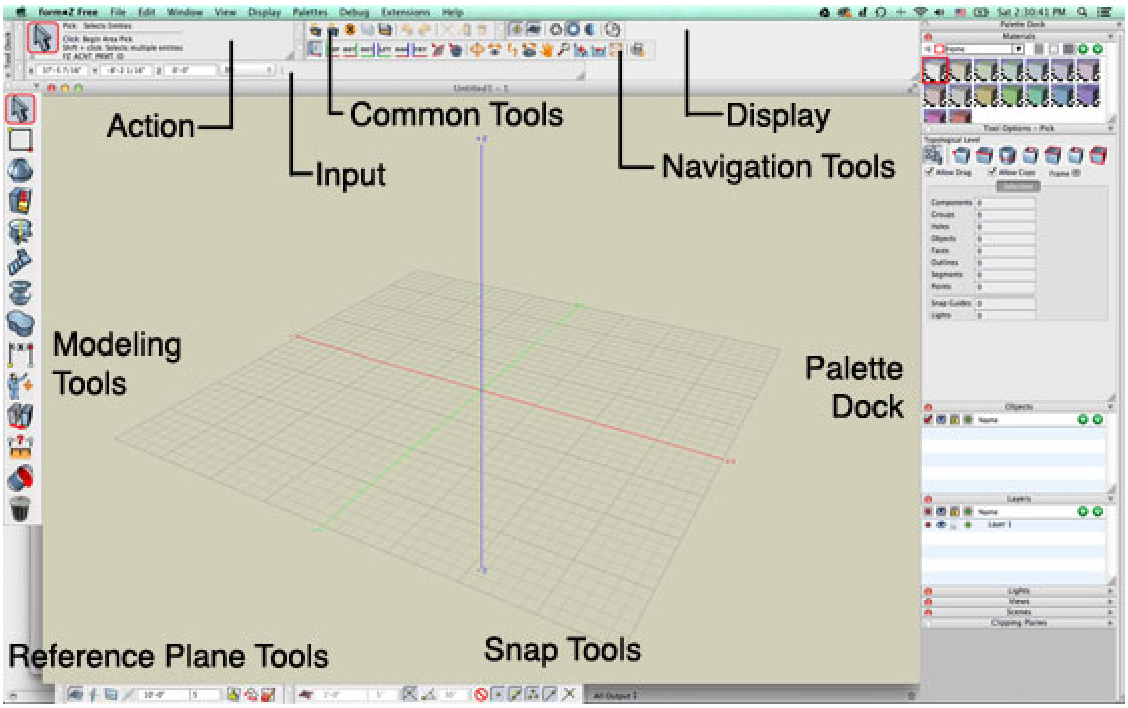
Layout and Interface

The **form•Z** interface is composed of **form•Z** project windows supported by a set of **menus**, **tool bars**, and **palettes**. The project window is the focus of the interface. This is where a 3D model is created, edited, and displayed.

By default the window shows a perspective view into the modeling space. The Cartesian axes are shown to indicate orientation and a grid is displayed to indicate the reference plane and scale. The appearance of the project window, the working units, scale, and other parameters are set in the **Project Settings** dialog, invoked from the **File** menu.

The tools used to perform modeling operations are located in the **Modeling** tool palette to the left of the project window. Each row in the modeling tool palette contains a **suite** of functionally related tools, whose label appears vertically to the left of the icon. When the cursor is positioned over the icon, the complete tool suite pops-up to the right of the icon. Clicking on an icon in the tool suite makes it the active tool and its icon is displayed in the modeling tool palette. The tool suite can be torn-off by clicking and dragging in its title bar.

There is always one **active** tool. The active tool is indicated by a red outline around the tool's icon. Clicking on a tool makes it the active tool. The icon and name of the active tool are shown in the **Action** palette located at the top of the screen. Most tools have a variety of options that control the functionality of the tool. These options are found in the **Tool Options** palette located to the right of the project window.



The form•Z Free screen layout.

The active tool determines the action that is applied when clicking in the project window. The basic **form•Z** workflow is as follows:

1. Select the desired tool.
2. Choose the desired options from the tool options palette.
3. Click in the modeling window as needed to perform the action. The **Action** palette indicates what each click will do. The **Input** palette can be used to enter values numerically for many tools.
4. Review the results. Most tools have the ability to make changes to the result without having to re-execute the tool. These tools show their results in orange in the project window. Tool options can be changed and are immediately reflected in the result object. Some tools provide graphic editing of the result through on screen controls.
5. Continue to the next operation.

The remaining tool palettes offer additional functionality used to support the modeling functionality. At the bottom of the screen are the **reference plane** tool and **snap tool** palettes. At the top of the screen are the **display** tool and **navigation** tool palettes. These tool palettes are discussed in more detail later in this document.

The **common** tools palette is a collection of commonly used items from the **File** and **Edit** menus. This includes **New Project, Open, Close, Save, Save As, Undo, Redo, Cut, Copy,** and **Paste**.

The **Materials, Objects, Layers, Lights, Views, Scenes, Custom Reference Planes**, and **Clipping Planes** palettes are all used to manage information of a project.

The **Display Options, Material Parameters, Reference Plane Parameters, View Parameters,** and **Components** palettes control the options for the current display, active material, reference plane, view, and components, respectively. These palettes are closed by default but can be opened by selecting the palette's name from the **Palettes** menu.

The palettes on the right of the screen reside inside a palette dock. A dock is essentially a palette that holds other palettes. When the dock is moved, all of the palettes in the dock move with it. When a dock is closed, all the palettes in the dock are no longer visible. A palette can be moved out of the dock and positioned anywhere on the screen. The dock on its right side has a scroll bar to allow scrolling of the palettes when the area required by the palettes is larger than the screen.

View navigation and control

There are a variety of ways to control the current view (navigate) in a **form•Z** modeling window. These include items in the **View** menu, the **Navigation** tool bar, **key shortcuts**, a **3Dconnexion** space ball, and the **View Parameters** palette.

View menu and tools

The **View** menu contains items for changing the view type between **Axonometric, Isometric, Oblique, 3** and **2 Point Perspective**. It also contains items for changing to a projection view (**Top, Bottom, Right, Left, Front, Back**) or back to a **3D View**. The **Cone Of Vision** item invokes a special multi-view environment that allows for precise graphic control over the view parameters with an interactive preview.

Navigation tools

The **Navigation** tool palette contains the following viewing icons, as found in the **View** menu. Note that these tools are sensitive to picked entities. When they exist they are placed at the center of the view.

3D View, TOP **Top**, BOT **Bottom**, RGT **Right**, LFT **Left**, FRT **Front**, BAK **Back**

The **Navigation** tool palette also contains the following additional tools:

Look at Reference Plane: When this is selected, the view is changed to look straight down onto the current reference plane.

Look at Face: This tool changes the view to look straight down onto a specific face of the model. When this tool is selected faces will highlight as the cursor rolls over them. When the desired face is highlighted, click to look at the face. The tool remains active for additional iterations.

Set View: This tool interactively orbits the view as the cursor is clicked and dragged in the project window. When the tool is selected the cursor changes to spinning arrows. Press the mouse at a starting location and keep the button down to interactively spin the view. Release the button when the desired result is achieved. If any object is picked or highlighted in the result color, the view spins around the center of that object. Otherwise, it spins around the centroid of the complete scene.The tool remains active for additional iterations. The default shortcut ***command/ctrl* + :** selects this tool.

Swivel: This tool interactively rotates the view about the click point.

Walkthrough: This tool allows you to browse a model by moving the observer through the scene, as common video games do. It is discussed in more detail in the next section.

Turn Table: See respective section later in this document.

Hand: This tool interactively pans the view as the cursor is clicked and dragged in the project window. When the tool is selected the cursor changes to a hand. Press the mouse at a starting location and keep the button down to interactively drag the view. Release the button when the desired result is achieved. The tool remains active for additional iterations.

Zoom: This tool zooms the view in (closer) or out (further) centered on the cursor location. When the tool is selected the cursor changes to a magnifying glass. Clicking the mouse at the desired cursor location performs the zoom. By default the tool zooms in. Pressing the ***command/ctrl*** key zooms out. Pressing the ***shift*** key when clicking invokes a selection rectangle to select an area to be zoomed on.

Zoom In By Frame: This tool allows you to click and drag to draw a rectangle which delineates the area to be zoomed in, by default. Pressing the ***command/ctrl*** key it zooms out.

Zoom In Incrementally: Each selection of this tool zooms the view in (closer) around the current view center. The shortcut of this action is ***command/ctrl* + *[***.

Zoom Out Incrementally: Each selection of this tool zooms the view out (farther) around the current view center. The shortcut of this action is ***command/ctrl* + *]***.

Fit All: This tool zooms the view such that all visible objects in the project fill the window. When the scene contains picked objects, then these become the basis for the fitting and all unpicked objects are ignored. The default shortcut of this action is ***command/ctrl* + *F***.

Match View: See section "Matching views to pictures" later in this document.

Multi View: This tool toggles the project window between a single view and multiple views. This is the same at the **Multi View** menu item in the **Windows** menu.

Walkthrough

The **Walkthrough** tool (👣) is a way to browse a model by moving the eye point (observer) through the scene as in common video games. The eye point is moved parallel to the ground plane (XY plane) as the mouse is moved. When the tool is active, a marquee is drawn in the center of the window as a navigation guide. To start moving, click the mouse and move in the desired direction of travel. Moving the mouse up and down moves the observer in and out of the scene. Moving the mouse right and left turns the observer in the respective direction. Note that it is common to click in the marquee as it is at the center of the scene, however, any location will work as well.

Additional keys can be pressed to change the movement direction. When the ***shift*** key is pressed (and held), the motion changes to moving up/down or left/ right (i.e. panning). Moving the mouse up and down moves the observer vertically (increases and decreases the height above the ground plane). Moving the mouse left and right moves the observer in the corresponding direction (instead of rotating).

Pressing (and holding) the ***option*** key (Macintosh) or ***alt*** key (Windows) allows for control of the head tilt (the angle of the line of site with the ground plane). When the key is pressed, moving the mouse up and down changes the view to the scene by looking higher or lower (i.e. to the sky or to the ground). Note that horizontal movement of the mouse still rotates the observer left/right.

The speed of the movement is controlled by how far the mouse is moved from the click point. The farther it is moved, the faster the observer will traverse the scene. The options for the **Walkthrough** tool allow for control over the maximum speed of the observer. This is the speed that is achieved when the mouse is moved near the edge of the window. The current speed is displayed in the palette as well.

Movement will stop when the observer approaches and collides with any part of an object in the scene. When this occurs, the marquee also changes to the current highlight color (red by default) to indicate that a collision has occurred. Deselecting the **Avoid Collisions** option disables collision detection and the observer will not stop when colliding with an object. Note that this will frequently place the observer inside of a solid object. When this happens the "backside" of the objects' surfaces are not visible, however the outline of the object remains.

Note that, when collision detection is enabled, it is important to consider the height of the observer. The default height is that of an average person. This simulates the effect of the full length of a person's body as he/she walks through the scene. Smaller objects in the scene, such as furniture will stop the observer, even though they may be difficult to see. If it is desirable to walkthrough the scene without such objects interfering, the **Observer Height** should be reduced (or made 0).

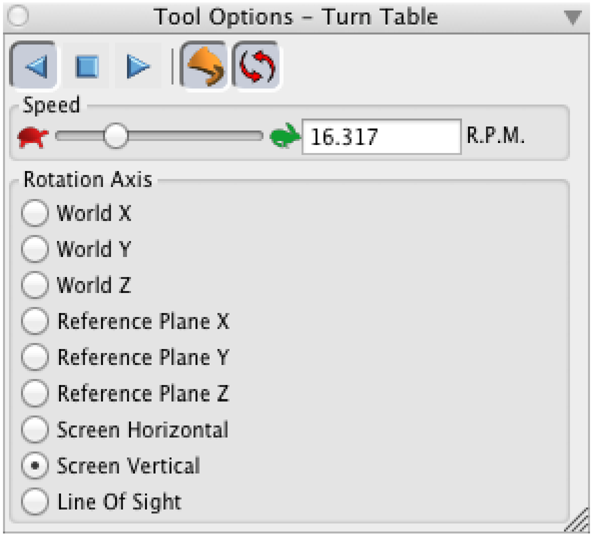
The ***command*** key (Macintosh) or ***ctrl*** key (Windows) can be used to change the state of the collision detection. Pressing and holding the key disables the collision detection if it is on. This is an easy way to get moving again, should the observer become stuck. Tapping the ***command/ctrl*** key toggles the state of collision detection.

The current eye height is shown in the **Tool Options** palette; this is the height of the eye point off of the ground plane. This number can be changed and the entire line of site is adjusted accordingly. The **Look Straight Ahead** button is a convenient way to reset the line of sight to be parallel to the ground plane.

Turn Table

This viewing tool causes a scene to continuously rotate about an axis, which is selected from the tool's palette. When the tool is activated, its **Options** palette is invoked, which, at the top, contains controls for playing and stopping the rotation. The right pointing arrow rotates to the right and the left arrow to the left. The square button stops the motion.

The **Speed** sliding bar controls the speed of the rotation and the **Rotation Axis** list provides a set of axes that can be used for the rotation.



Tool Options – Turn Table

Speed

16.317 R.P.M.

Rotation Axis

○ World X
○ World Y
○ World Z
○ Reference Plane X
○ Reference Plane Y
○ Reference Plane Z
○ Screen Horizontal
● Screen Vertical
○ Line Of Sight

Navigation using mouse buttons

There are a number of default shortcuts using the mouse buttons:

Scroll wheel/ball: Zooms the current view in or out at the cursor location as the wheel/ball is moved.

Double click middle button (scroll wheel/ ball): Fits all the visible objects of the project in the window.

Command/ctrl key + double click middle button (scroll wheel/ ball): Fits all the picked entities of the project in the window.

Click and drag middle button (scroll wheel/ ball): Interactively pans (drags) the view following the position of the cursor on the screen.

Command/ctrl key + right button: Interactively spins the view following the position of the cursor on the screen.

Navigation using key shortcuts

A number of default key shortcuts affect views:

Right arrow: Pan right.
Left arrow: Pan left.
Up arrow: Pan up.
Down arrow: Pan down.

Shift + up arrow: Move in.
Shift + down arrow: Move out.

Command/ctrl key + right arrow: Look to the right.
Command/ctrl key + left arrow: Look to the left.
Command/ctrl key + up arrow: Look up.
Command/ctrl key + down arrow: Look down.

3Dconnexion space ball

This is also available for navigating through your scenes and works in the standard manner for this device. For more information refer to the related documentation included in the plugins folder.

View Parameters palette

The **View Parameters** palette contains numeric information of the current view parameters. As the view is changed, the updated parameters are shown in the palette. The palette can also be used at any time to change the view by typing a new value in any of the numeric fields. The view type can also be changed from this palette. Selecting the **View Parameters** item from the **View** or **Palettes** menus opens the palette.

Prompts and Numeric Input

At the top left of the screen are the **Action** and **Input** palettes. They are designed to guide the user though the execution of a tool by giving short instructions of what to do next, presenting essential options, giving numeric feedback, and allowing the user to type numeric input values in place of graphic input through the mouse.

Action Palette

The **Action** palette shows the active tool's icon on its left side. Next to it, at the top of the text area is the title of the tool followed by a brief description of what the tool does. For example:

> **Reshape**: Reshapes an object by moving faces.

Below this description are instructions for what happens next. Depending on what state the execution of the tool is in the instructions may change. All tools require mouse clicks for their execution. Therefore the first instruction below the title is "Click" followed by a description of what happens with the next mouse click in the project window. For example, for the **Reshape** tool:

> **Click**: Select planar (flat) face to reshape.

Additional instructions may be presented below the click instruction. Those are usually options that can be used by holding down the **shift, control,** or **command** key while clicking. Again, for the **Reshape** tool this is:

> **Shift + Click**: Select multiple entities.

If all of the options do not fit in the palette, the text at the bottom of the palette will parade through all of the options available. The small dots under the active tool indicate how many "pages" of information there are.

Once a tool is executing and an interactive operation is performed, the instructions may change. For example, with the **Reshape** tool, after the face is picked, the extrusion of the face is dynamically updated between the first and second mouse clicks. During that time, the click has a new meaning and new options apply. Those are now shown in the palette:

> **Click**: New face location.
> **Tap Shift**: Toggles Keep Edges option.
> **Tap Command**: Toggles Perpendicular option.

Note, that "Tap" means hitting and quickly releasing the key, not pressing the key and holding it down. In contrast, "Shift + Click" means holding the key down while clicking.

Input palette

The Input palette contains two areas with numeric input fields. The first area, on the left, shows the x, y, and z values of the cursor position as it is mapped from the screen onto the current reference plane or to a snapped point. The x, y, and z values may be read out in four different ways, which is determined by the menu to the right of the three fields:

> **3D**: x, y, and z are shown as absolute values in the 3D world space. That is, they are shown relative to the origin of the world coordinate system.
>
> **3D Delta**: This option is only available if a point has been clicked during drawing. The x, y, and z values are shown as values relative to the previously clicked point and are expressed as 3D world coordinates. This allows the user to see, for example, how far from the last point a line was drawn.
>
> **Plane**: x, y, and z are shown as values relative to the coordinate system of the currently active reference plane. This plane may be the XY plane, the YZ, or ZX orthogonal plane or an arbitrarily oriented custom plane. The X axis is displayed in **red**, the Y axis in **green**, and the Z axis in **blue.** The values shown in the Input palette are measured along these axes.
>
> **Plane Delta**: As for **3D Delta**, this option is only available if a point has already been drawn. It shows the x, y, and z values relative to the previously clicked (drawn) point in

the coordinate system of the current reference plane. **Plane** and **Plane Delta** are useful options for example, when inserting a window into a wall. First, you define a reference plane on a vertical face (the wall), with the plane's origin at the lower corner of the wall. Then, you use the **Insert** option of the **Rectangle** tool. Then, you choose **Plane**. As the mouse is moved over the face, the coordinate readout shows the x and y distance of the cursor relative to the lower corner of the wall. Now an opening can be drawn precisely at a desired offset from the wall corner. While the rectangle is interactively drawn, switch to **Plane Delta**. Now the x, y, and z values of the current point are shown relative to the first clicked point of the rectangle. Note, that the rectangle **Length** and **Width** are also shown in the **Input** palette, as described in more detail below.

The second area of the **Input** palette displays numeric fields that are specific to the current operation. For example, drawing a rectangle shows two fields, **Length** and **Width**. Extruding a shape shows one field, **Height**. Tools that do resort to graphic input during their execution will not display any fields in this area. The behavior of the numeric input fields in this area is slightly different from the x, y, and z input fields. If the user types a value and hits the **tab** key, this value is locked until the **return** key is hit, or the mouse is clicked.

For example, start drawing a rectangle by clicking on the reference plane. While the second point is interactively drawn, the **Length** and **Width** fields show the current dimensions of the rectangle. Now, type a value in the **Length** field and hit the **tab** key. This advances the focus of the text input to the **Width** field and locks the length of the rectangle to the type value. Notice that the width of the rectangle is still determined by the mouse value, while the length stays the same. Now, type a value in the **Width** field and hit **tab**. Now, both length and width are defined and locked and the rectangles shape will not change anymore. Hit return or click with the mouse to finish the input.

Note that just hitting the **tab** key without typing a value in the text fields will not lock the values. Anytime the **return** key is hit during interactive input, it is interpreted as a mouse click, accepting the values in the Input palette instead of the cursor's mapped 3D location.

Reference planes

Graphic interaction with **form•Z** is interpreted relative to the active reference plane. A reference plane is a plane in 3D space used as the workspace for drawing and the basis for other interactive actions. The initial reference plane is the XY plane (or ground plane). The reference plane may be one of the three Cartesian planes (XY, YZ, ZX), or it may be a custom plane. A custom plane can be positioned anywhere in 3D space and is defined from faces of an object or is derived from one of the Cartesian reference planes. A special type of custom plane is the face reference plane, which is created automatically when using a tool for drawing objects and the mouse is positioned on a face of an existing object.

By default, reference planes are shown with a grid and axes. The X axis is displayed red, the Y **green**, and the Z **blue**. The color of the grid and axes is controlled by settings in the **Appearance** tab of the **Project Settings** dialog (accessed from the **File** menu). The display of the grid and axes can be disabled with tools in the **Display** tool palette.

The **Reference Plane** tool palette is located at the bottom left edge of the screen. It contains tools that can be used to switch between the reference planes, define and edit planes.

XY Plane, **YZ Plane**, **ZX Plane**: Make the XY, YZ, or ZX reference plane active, respectively.

The **Reference Plane Parameters** palette that can be invoked from the **Palettes** menu, contains the parameters of the current plane. This includes a control for the plane's underlay. The underlay is an image that can be displayed on the plane. This is useful for referencing or tracing images.

Custom Plane: Makes active the custom reference plane that is active in the **Custom Reference Planes** palette. This palette can be invoked from the **Palettes** menu and contains a list of all the custom planes that have been defined. It can be used to manage the custom planes, including the selection of the active custom plane.

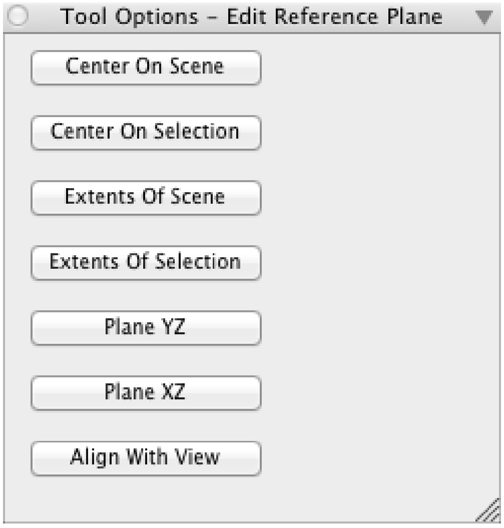
10'-0" 5

Module and Divisions: A grid may be drawn depicting the reference plane, depending on whether **Show Grid** is selected in the **Display** menu. The density of the grid is specified by the values in these two fields. The module value specifies the interval at which a heavy line is drawn. The divisions value specifies the number of subdivisions in each module. These subdivisions are drawn in lighter lines.

Define Reference Plane: This tool allows you to define custom reference planes from points, segments, or faces of objects. A custom plane must be defined using 3 points, a point and a segment, 2 segments, an outline, or a face. To create the custom reference plane, with the tool selected, click any parts of an object that will satisfy the previously stated criteria and the reference plane will appear in the project window.

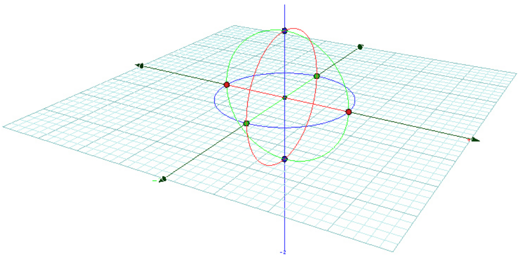
Edit Reference Plane: This tool allows you to manipulate a reference plane grid and to derive a custom plane from it. There are seven buttons in its tool options palette:

Center On Scene changes the origin of the plane to the center of the scene extents. **Center On Selection** changes the origin to the center of the selected entities. **Extents Of Scene** changes the extents of the plane to the scene extents. **Extents Of Selection** changes the extents of the plane to the extents of the selected entities. **Plane YZ** and **Plane XZ** change the plane to the **YZ** or **XZ** plane of the current reference plane. **Align With View** changes the plane to coincide with the picture plane of the current view, with Z aligned to the line of sight, X to the horizontal and Y to the vertical axes of the screen.



The Edit Reference Plane Tool Options Palette

Activation of this tool also displays controls on the reference plane grid, which can be used to graphically reshape the plane. By picking and dragging the **border arrows** that appear on the four border lines you can expand or shrink the respective side of the reference grid. By rotating the **circular dials** that are centered at the origin of the plane you can rotate the plane grid in three directions. You can also move the grid by moving the **bullet** at its origin.



The XY reference plane grid with its controls displayed.

Lock Reference Plane: This is a switch. When this switch is on, the reference plane is locked and does not automatically change when using one of the drawing tools. When this switch is off and you place the mouse cursor on the surface of an object, while a drawing tool is active, drawing will occur on the surface of the object. This tool can also be accessed by its key shortcut (F5) which is useful when the mouse is positioned on a face of an object and the icon cannot be used.

Underlays

This is an image that can be imported and displayed on any active reference plane, useful for referencing or tracing. An underlay can be any of the available image formats (except Illustrator). These image files can be created in **form•Z** or by an external source such as another application or an image scanner.

- To place an underlay on the active reference plane, from the **Palettes** menu, invoke the **Reference Plane Parameters** palette. In it, turn on **Underlay**.

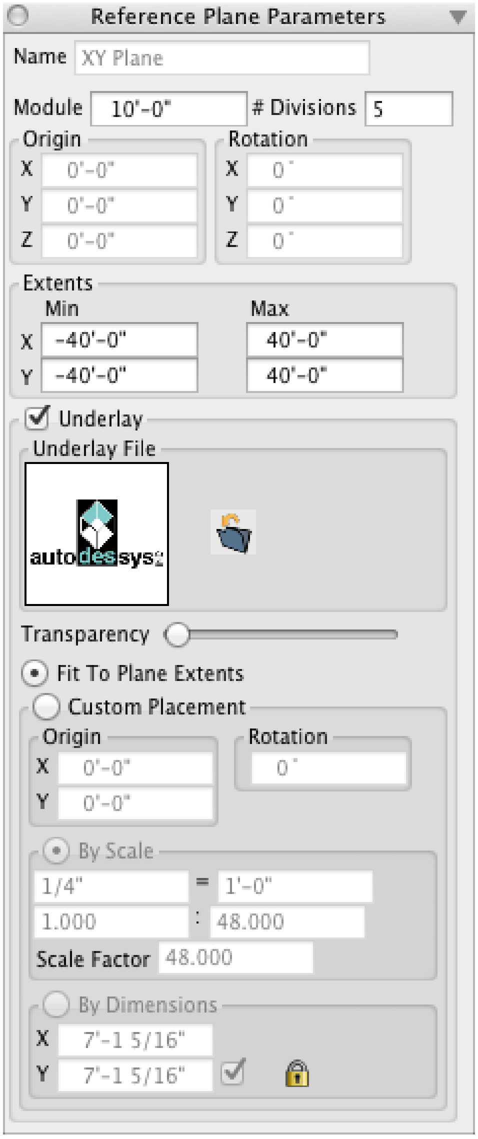
The image shown in the **Underlay** box of the dialog appears mapped on the active reference plane immediately. By default, this is an image with the AutoDesSys logo.

To place a different underlay, in the **Reference Plane Parameters** palette, click on the **Open** icon (📂), found next to the **Underlay** box, to invoke the **Underlay** dialog. In it, click on the **Load...** button. This invokes the standard **Open File** dialog from where you can choose an image file. As soon as you click **OK**, the image appears in the **Underlay** dialog. As soon as you close this dialog (by clicking on its OK button) the image appears in the **Reference Plane Parameters** palette and on your active reference plane.

The underlay image remains visible as long as the reference plane remains active. If you make another plane active, the image will disappear, but you can assign an underlay image to that plane as well. In general, there can be as many underlays as reference planes, but only one is displayed (that of the active plane) at any given time.

At the lower portion of the **Reference Plane Parameters** palette, there are more options:

The **Transparency** sliding bar controls how transparent the underlay image may be. At the far left, the image is completely opaque. At the far right, it is invisible. Between the two ends different degrees of transparency can be set.



Reference Plane Parameters

Name: XY Plane

Module: 10'-0"
Divisions: 5

Origin: X 0'-0", Y 0'-0", Z 0'-0"

Rotation: X 0°, Y 0°, Z 0°

Extents: Min X -40'-0", Min Y -40'-0"; Max X 40'-0", Max Y 40'-0"

☑ Underlay

Underlay File

Transparency

● Fit To Plane Extents

○ Custom Placement

Origin: X 0'-0", Y 0'-0"

Rotation: 0°

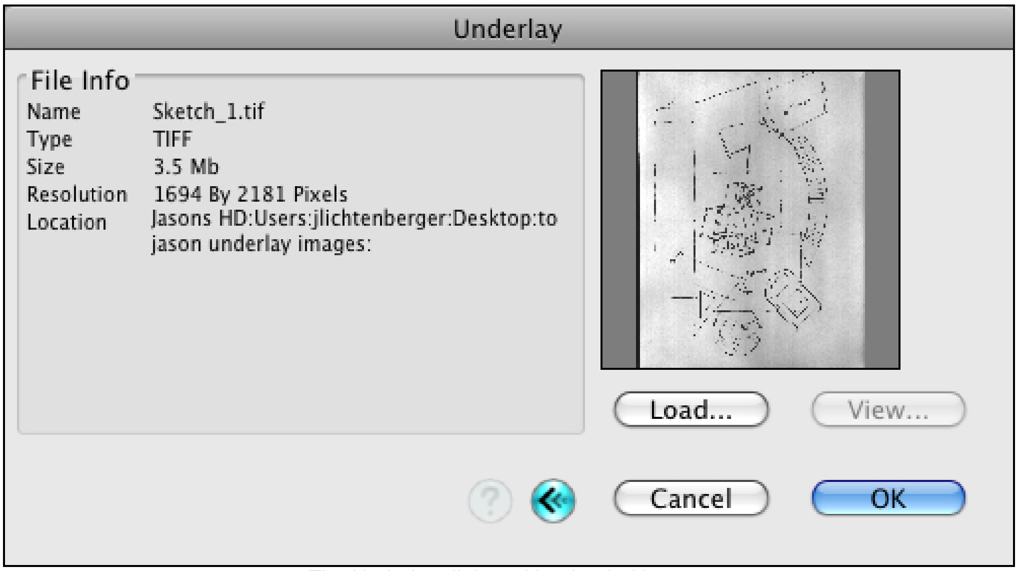
○ By Scale: 1/4" = 1'-0"; 1.000 : 48.000; Scale Factor 48.000

○ By Dimensions: X 7'-1 5/16", Y 7'-1 5/16"

An Underlay displayed in form•Z.

There are two methods for placing an underlay image: **Fit To Plane Extents** sizes the image to exactly fit the reference plane. **Custom Placement** allows you to enter specific placement and orientation parameters.

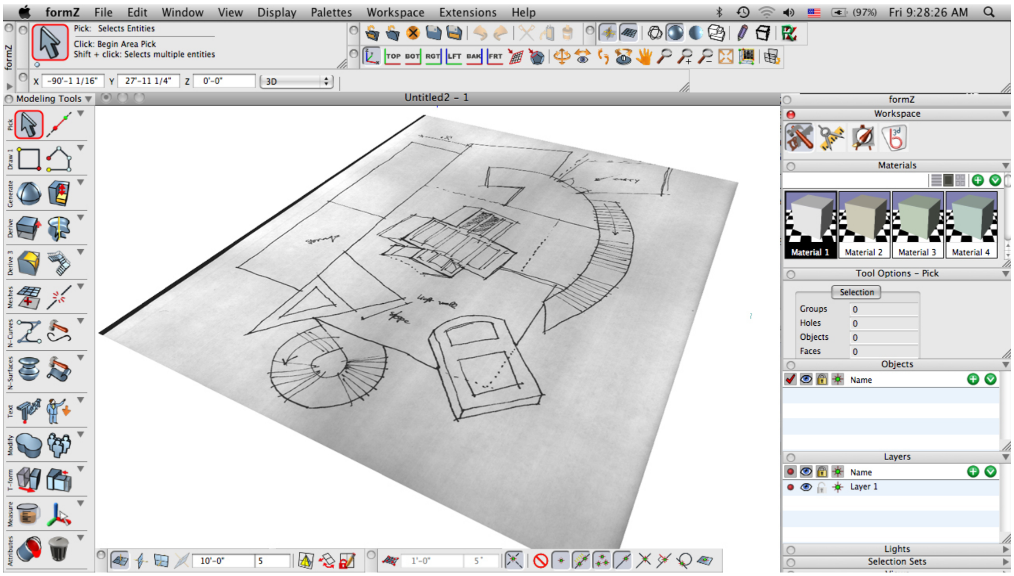
The **X** and **Y** values of **Origin** position the origin of the underlay image and the angle value in the **Rotation** field orients it. Then the exact size of the image may be set by one of two methods: **By Scale** allows you to define a scale for the image using one of three formats: inches, ratio, or scale percentage. These are correlated and changing one automatically updates the other two. **By Dimensions** allows you to set the size of the underlay image be explicitly entering its **X** and **Y** dimensions. Note that the two can be locked to be the same if a square shape is desired.


Underlay

File Info

Name	Sketch_1.tif
Type	TIFF
Size	3.5 Mb
Resolution	1694 By 2181 Pixels
Location	Jasons HD:Users:jlichtenberger:Desktop:to jason underlay images:

The Underlay dialog with a loaded image.



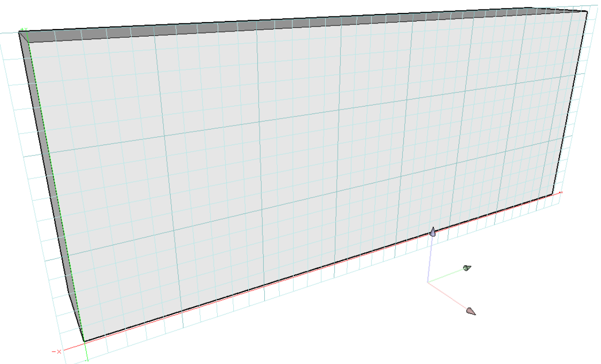
Pick: Selects Entities
Click: Begin Area Pick
Shift + click: Selects multiple entities

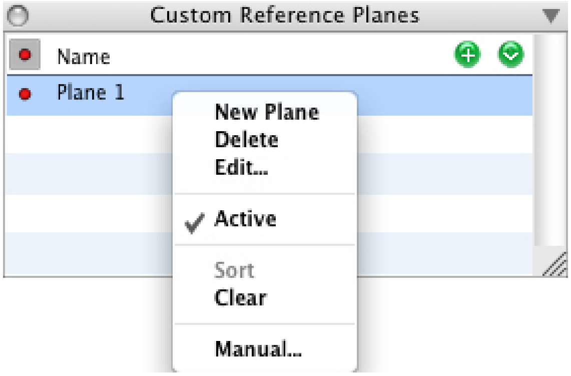
Groups	0
Holes	0
Objects	0
Faces	0

Image loaded image as an underlay in **form•Z**.

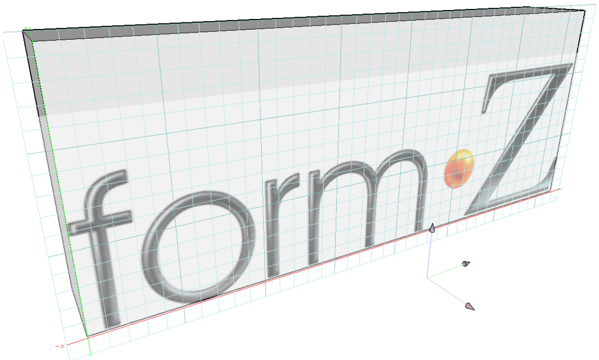
Underlays on custom planes

In addition to the Cartesian reference planes (XY, YZ, and ZX), underlays can also be placed on any custom plane. Recall that these can be generated using the **Define Reference Plane** tool () or the **Edit Reference Plane** tool (), both located at the lower end of the **form•Z** window. Also, recall that these are listed in the **Custom Reference Planes** palette, from where they can be activated. Once active, an underlay can be assigned to them as for the Cartesian planes. Note, however, that for custom planes generated from faces of objects, use of the **Translucent** option is advisable to make sure they are visible.


A custom plane created on the face of an object.



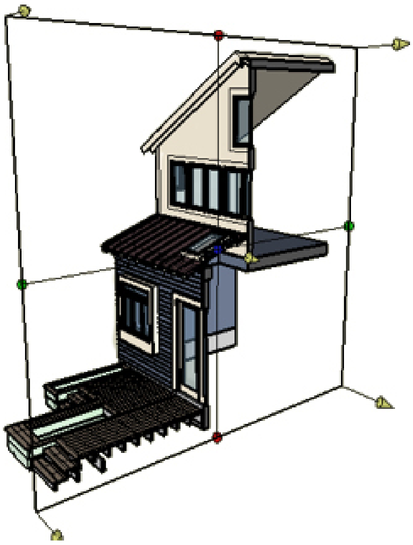
The Custom Reference Planes palette with its context menu invoked.



An underlay placed on the face of an object with the Translucent option active.

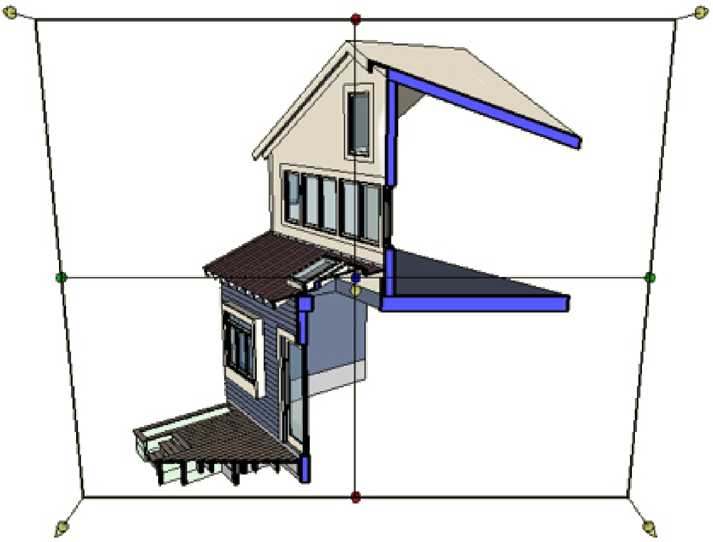
Clipping Planes

Clipping planes are a useful way to see the inside of a model by cutting away part of the model to reveal the interior and the structure of its mass. The **Section** tool, discussed later, can be used to accomplish this, however, it actually cuts the model. While this might be desirable in some cases it is often desirable to have a way to visualize sections of the model without affecting the model itself. A clipping plane is used for just such visualization. A clipping plane cuts the scene at a desired location. Multiple clipping planes can be maintained in the **Clipping Planes** palette making it easy to switch to different cut-away views with a single click. To create a clipping plane, first open the **Clipping Plane** palette (located at the bottom of the palette dock). Click on the **New** (⊕) icon at the top of the palette. A new clipping plane is added to the palette and it becomes the active clipping plane. The plane is positioned by default in the middle of the visible objects and oriented parallel to the XY, YZ, or XZ plane depending on which plane best faces the current viewing position.



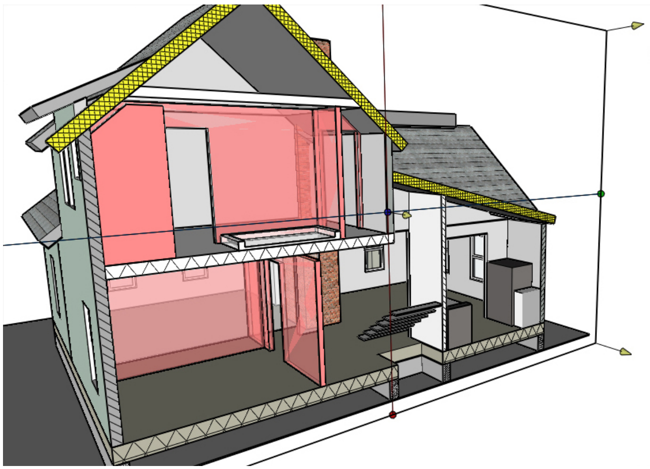
Clipping plane parallel to XY and positioned in the middle of the visible objects.

You can also create a clipping plane that is positioned relative to the current view. That is, a plane that is perpendicular to the current line of sight. To do so, select the **New Clipping Plane From View** item from the context menu, accessed from the icon (⌄) in the upper right of the **Clipping Planes** palette.



Clipping plane perpendicular to the line of sight.

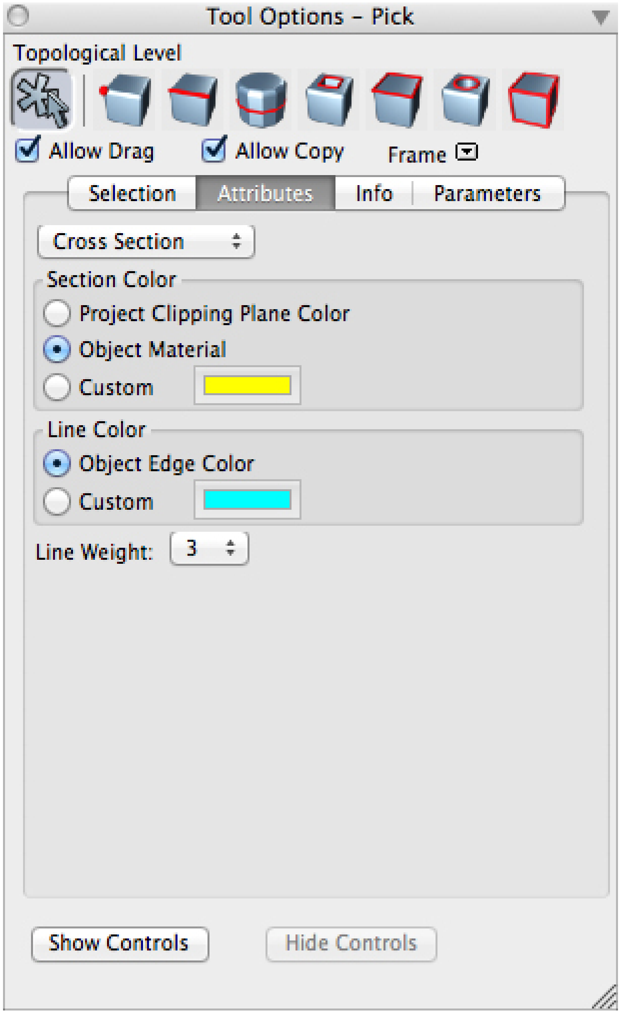
When a new clipping plane is created, it is made active and the plane is shown graphically on the screen. The graphics include a number of on screen controls that are used to graphically edit the position and orientation of the plane. There are 5 arrow controls that point in the direction of the cutaway mass and can be used to reposition the clipping plane along its primary axis (perpendicular to the plane). The blue dot at the center of the plane can also be used to move the plane along the axis; however, it works a differently than the arrows. When using the blue dot, the model is not sectioned live as the clipping plane is moved. This allows for the plane to be positioned accurately by snapping to parts of the model. Note that you may first need to move the clipping plane once to reveal the part of the model you desire to snap to and then move it to its final position.



Cross sections painted differently.

The green and red dots can be used to rotate the clipping plane. Note that, when the plane is rotated, the graphics are updated so they are big enough to enclose the entire visible model (if the clipping plane was positioned at the widest portion relative its axis).

The clipped cross sections can be painted with different colors or have hatch patterns assigned to them. This is done through the ***cross section*** attribute that is assigned to all objects. You can access the parameters of this attribute through the **Pick Tool Options** palette. With the **Pick** tool select the object to invoke its tool options palette, then select Attributes, and, from the popup menu on the top, select **Cross Section**. The options displayed contain parameters for the **Section Color**, **Line Color** and **Line Weight**. Any change you make to any of these parameters will be reflected to the display of the cross section on the screen.



☑ Allow Drag
☑ Allow Copy

Cross Section

Section Color
○ Project Clipping Plane Color
● Object Material
○ Custom 🟨

Line Color
● Object Edge Color
○ Custom 🟦

Line Weight: 3

Cross Section options in Attributes tab of
Pick Tool Options palette

Right clicking on any of the editable controls invokes a context menu with three items. When the **2D option** is selected, only the 2D intersection with the clipping plane is shown. The **Flip** item reverses the direction of the active clipping plane. That is, it toggles which side of the model is visible and which is cut away. The **Make Permanent (Cut Section)** item actually cuts the model at the clipping plane. This is equivalent to using the Section tool on the visible objects along the clipping plane.

When a clipping plane is active the plane affects the entire working environment. You cannot pick objects or parts of objects that are not visible. Likewise snapping does not work on the portions that are cut away. The clipping plane does not affect guides and other on screen graphics and controls. The faces of solid objects created by the clipping plane are shown with a dark gray color by default. The color can be changed in the **Appearance** tab of the **Project Settings** dialog, by using a custom style.

The **Clipping Plane** palette is used to manage the clipping planes. The first column of the palette shows whether the plane is active, which is indicated by a red dot (●). Click in the column to make the corresponding plane active or inactive. Multiple planes can be active at the same time. The second column controls the visibility of the on screen controls. By default, the controls are visible but they can be hidden using this column. The name of the plane is found in the third column and can be edited in the standard fashion.

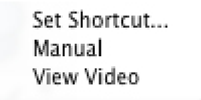
At the top of the palette are some additional controls. These are enabled when a plane is highlighted in the palette by clicking on the name of the plane. The **Flip** (↻) icon reverses the direction of the active clipping plane. That is, it toggles which side of the model is visible and which is cut away. The **Play** icon (▶) animates the plane along the primary axis. The **Stop** icon (■) stops the animation at the current location.

The palette's context menu can be accessed by right clicking in the palette or from the standard context menu icon at the top right of the palette. As with all palettes, this menu offers easy access to actions that can be performed in the palette.

Clipping planes are included in scenes by default. This allows for a quick way to link a clipping plane with a specific view. That is, by saving a scene with a specific view and clipping plane, you can easily recall them both together. Clipping planes can be excluded from the scene by un-checking the **Clipping Plane** item in the **Scene Options** dialog.

Context Menus

Context menus can be invoked by clicking the right button of the mouse. Depending on where the mouse is when right-clicking, a different context menu will pop up (on OSX ***control* + *click*** can be used when no right mouse button is present). They generally contain items that affect the program feature on which the click occurred. For example, right-clicking on a palette invokes a menu with items relating to that palette. Regarding the tool icons, there are three types of context menus:



The Icon context menu.

Icon menu: Right-clicking on any tool icon invokes this menu, which contains three items:

Set Shortcut...: Selecting this item invokes the **Key Shortcut** dialog when a key command can be defined for the respective tool.

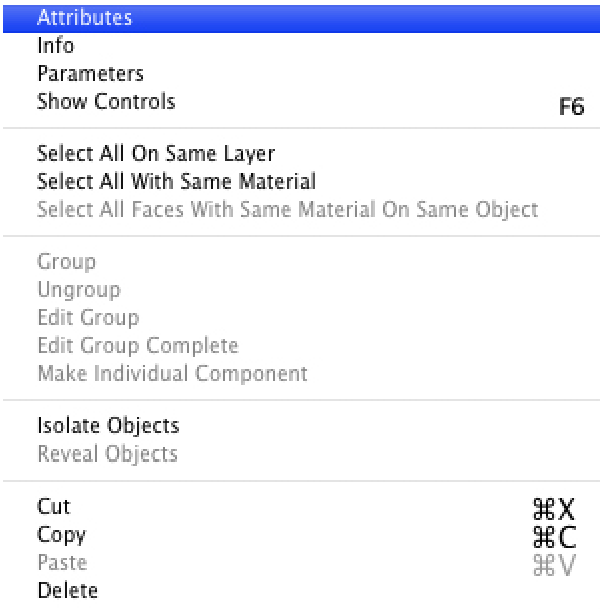
Manual: Selecting this invokes the **form•Z** manual.

View Video: Selecting this invokes the **form•Z** video tutorials.

Pick menu: When the **Pick** tool or another tool that picks is active and you right-click anywhere in the project window, the menu pops up. It contains three groups of items.

Attributes, Info, Parameters, Show Controls: All these are options also available in the Pick tool options palette and are repeated here for convenience.

Select All On Same Layer, Select All With Same Material, Select All Faces With Same Material On Same Object: Selecting one of these items picks a group of objects that meet the specifications in the respective items.



The Pick context menu.

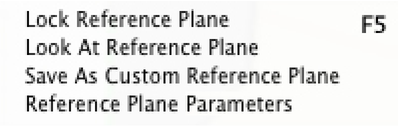
Group, Ungroup, Edit Group, Edit Group Complete, Make individual Content: These are items found in the Edit menu and are repeated here for convenience.

Isolate Object, Reveal Object, Paste: These again are items found in the **Edit** menu and are repeated here for convenience.

Cut, Copy, Paste, Delete: As the above items, these are commands found in the Edit menu and are repeated here for convenience.

Reference Plane menu: When a tool that draws or uses the reference plane is active and you right-click, the menu pops up.

Lock Reference Plane: This accesses the **Lock Reference Plane** function discussed in the previous section.



The Reference Plane context menu.

Look at Reference Plane: When this is selected the view is changed to look straight into the current reference plane.

Save As Custom Reference Plane: The current reference plane is added to the **Custom Planes** palette and the active reference plane is switched to the new custom plane.

Reference Plane Parameters: When selected, the **Reference Plane Properties** palette is displayed. This palette contains numeric fields for all of the parameters of the active reference plane.

Snapping

There are three kinds of snaps, which can be turned on and off separately: **grid snaps**, **guide snaps**, and **object snaps**.

Grid snaps

Grid Snap: This tool, found on bottom of the screen, is a switch. When on, grid snapping is on; when off, it is off. Next to it there are two fields: one for linear distances and one for angles. All linear input that defines points in space or linear distances is affected by the linear grid snap. It applies equally to X, Y, and Z directions. A few input mechanisms define angles, such as drawing arcs or rotating objects. They are affected by the angle grid snap. For convenience, the grid snap values can be accessed directly in the text fields next to the **Grid** icon. To invoke the **Grid Options** dialog, right click over an object snap icon and choose **Snap Options**, or choose **Snap Options** from the palette menu.

Guide Snaps

Guides are auxiliary lines that extend infinitely long. Their purpose is to lock on to certain points along a meaningful direction. Guides are generated in one of three ways:

1. Permanent guides are generated by the user with the **Draw Guide** tool ( ), found in the **Manage** suite of tools. They are always drawn with black dashed lines. They can be picked, moved, rotated, and deleted. **Permanent** guides are located on the layer that is active when they are drawn. If that layer is turned off, the guides will also disappear. **Permanent** guides are saved with the project.

2. Temporary guides can be generated by the user anytime object snaps are active. The cursor must snap to one of the object snaps, such as a point, interval, or segment. When this happens the user may press ***shift+space*** to create a series of guide lines through the snapped entity, according to the following rules:

    - When snapping to a point, guide lines are generated parallel to the X,Y, and Z directions of the current reference plane.
    - When snapping to a segment or segment interval, guide lines tangent and perpendicular to the segment at the snap point are generated, in addition to the X,Y, and Z directions, whenever they are different from the X,Y, and Z directions.

    At most three such sets of temporary guide lines can be active. If a fourth set is created, the oldest set is removed. Temporary guides remain associated with the object where the snap occurred. If the object is edited and changed, the temporary guides for that object are removed. Pressing ***shift+cmd+space*** (shift+ctrl+space on Windows) will delete all Temporary Guides.

3. Automatic guide lines are created during dynamic input, such as when drawing, transforming, extruding, etc. Depending on the type of input, guide lines that are parallel to the X and Y directions of the reference plane, tangent, and perpendicular to a drawn segment and/or perpendicular to the reference plane are created. After the input is completed, they are automatically deleted. They only exist during the execution of the tool.

If temporary and automatic guides are drawn, they are color coded: parallel to X is **red**, to Y is **green**, and to Z is **blue**. Tangent, perpendicular, or other directions are **magenta**. **Angle** snaps are lilac.

Guide Snap: This switch, located at the bottom of the project window, allows the user to turn guide snapping on and off. If on, and the cursor is close to a guide line, it snaps to that line. If the cursor is close to the intersection of two guide lines, it snaps to it too.

Angle Snap: When on, snapable guides set at a specified angle appear to the left and right of the last point drawn. The angle is set in the field next to the **Angle** icon.

Intersection Snap: When this switch is on, the cursor also snaps to the intersection of a guide with a segment. When the cursor snaps to a guide line and the shift key is held down, the snapped point remains on that guide line, no matter where the cursor is moved. In that case, the cursor point is always projected perpendicular on the guide line. When snapping to a guide, or the intersection of two guides, a solid line in the color of the type of guide (see above) is drawn from the snapped point on the guide to the guide line's origin.

It is possible to delete individual lines of a snap guide. While the cursor is snapping to a guide line, hit the **space bar** key and that line is removed. This may be useful if too many guide lines populate the screen. For example, only the tangent direction of a snap guide may be desired. Initially the X, Y, Z, perpendicular, and tangent direction are generated as guide lines. Snapping to the X, Y, Z, and perpendicular line and hitting the **space bar** key removes them one at a time.

All temporary and automatic snap guides can be deleted by hitting the **shift + space bar** keys at any time.

Object Snaps

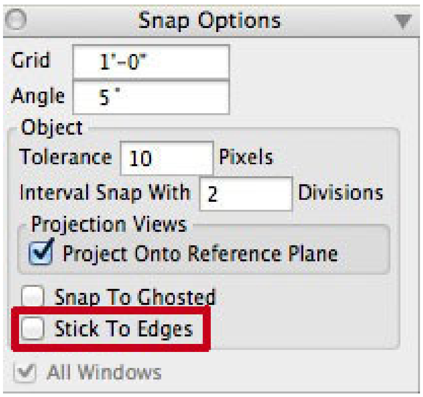
The **Snap** tool palette at the bottom of the project window contains tools that allow you to snap to parts of objects.

Object Snap: When this switch is on, snapping to parts of objects is enabled and the snap tools next to it further determine which object parts can be snapped to. They are:

- **Snap to Point**
- **Snap to Interval**
- **Snap to Key Points**
- **Snap to Segment**
- **Snap to Intersection**

All of the above are self-explanatory except the **Key** points, which are discussed in the next section.

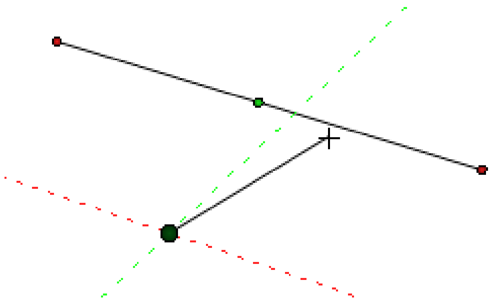
As with the **Grid Snap Options** dialog, right-click the mouse over one of the object snap icons and choose **Snap Options** to invoke the **Object Snap Options** dialog. One or more of the object snap icons can be active at the same time. The cursor will automatically snap to the object part that is closest. In addition, when the cursor is located over a segment, a preview of the possible snap choices is drawn. For example, if point, segment, and interval snaps are active and the cursor is located over a segment, small red circles are drawn for the two end points of the segment and green circles for the interval points. If the cursor is not close to any of these entities, it is snapped to the segment. If it is close to one of these points, it is snapped to it. A larger green point is drawn where the cursor is snapped to an object part. The small preview points for snap choices along a segments are color coded: segment end points are red, segment interval points are **green**, and intersection points of segments with other segments and guides are **blue**. Points tangent or perpendicular from the current point while drawing are **magenta**.



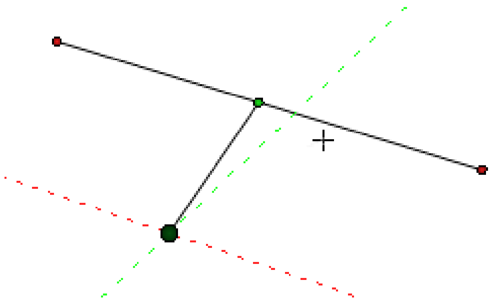
Grid 1'-0"
Angle 5°
Object
Tolerance 10 Pixels
Interval Snap With 2 Divisions
Projection Views
☑ Project Onto Reference Plane
☐ Snap To Ghosted
☐ Stick To Edges
☑ All Windows

The Object Snap Options Dialog..

Stick To Edges When this option is enabled, the snap point will stick to the nearest snap candidate point on the edge. That is the snapping will lock onto the nearest snap point of the edge, even if the cursor is not within the pixel tolerance of the point. This is similar to how snapping working in prior versions of **form•Z**. This new option works with the **Point, Interval, Intersection, Perpendicular** or **Tangent** snap modes but not when **Snap To Segment** is enabled (as the point on the segment takes precedent).



Snapping with Stick to Edges Off

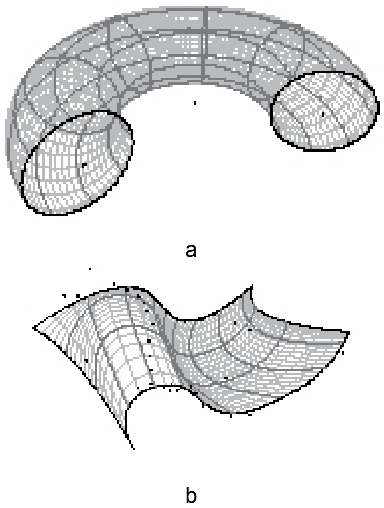


Snapping with Stick to Edges On

Key Points

Key points are points of an object that are critical to the shape or the controls of the shape. Examples of **key** points are the centers of circles and the control points of spline or nurbs objects. The **key** points available per type of object are listed on the right. **Key** points can be shown when objects are displayed in **Wire Frame** or **Shaded Work** modes and the **Show Key Points** option is on in the respective **Options** dialog.

Selecting the **Snap To Key Point** icon causes the cursor to snap to the key points of an object.



Examples of key points on (a) a partial primitive and (b) a nurbs object.

Object Type	Key Points
Cube	Center of each side face
Cone	Center of bottom and apex or center of top, if the cone is truncated
Cylinder	Centers of bottom and top faces
Sphere	Center
Torus	Center. Start and end points of the torus arc, if the torus is partial
Spherical Object	Center
Composite Curve	Key points of component curves, plus corner points of any straight line segments
Spline	Control points
Arc	Start point of arc, center of arc, end point of arc
Circle	Center
Ellipse	Center
2D Enclosure	Key points of base shape
Extrusion	Key points of base shape
Convergence	Key points of base shape
3D Enclosure	Key points of base shape
Revolved Object	Key points of source object
Spiral Stair	Axis point at top and bottom of stair
Stair From Path	Key points of path object
Nurbs Curve	Control points
Nurbs Object	Control points
Text	Placement point for Text At Point

The key points of different types of objects.

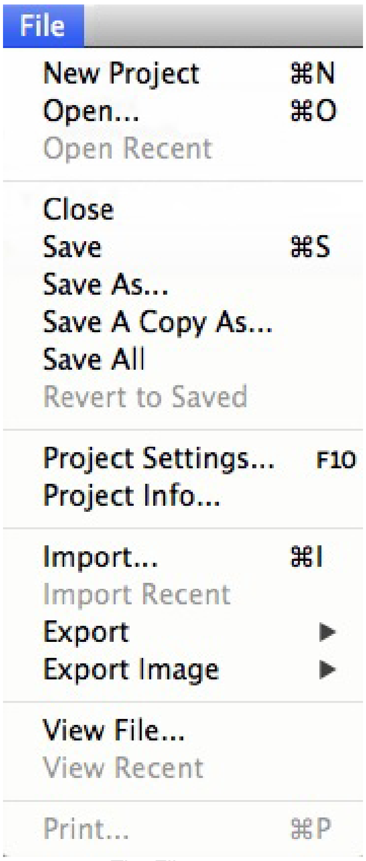
Taps

Taps may be thought of as a special type of key shortcuts that can be conveniently used to switch the action of a tool. They involve quickly hitting (tapping) a key while a certain tool is active, to toggle between alternative effects. They are preset by the system and cannot be programmed by a user. They involve the ***shift, command*** (Macintosh) or ***control*** (Windows), and ***option*** (Macintosh) or ***alt*** (Windows) keys, whose effect per tool is as follows:

Tool	**Key**	**Action**
Pick	command/control shift option/alt	While dragging an entity, toggles between move perpendicular and move parallel to reference plane. While dragging an entity, toggles between allow and disallow snapping to original. While dragging to transform an entity, toggles between most recently selected copy mode and self.
Area Pick	command/control	Toggles select and deselect option.
Rectangle **3-Point Rectangle** **Circle 1** **Circle 2** **Circle 3** **Ellipse 1** **Ellipse 2**	shift	Toggles insert option on/off.
Vector Line **Stream Line**	command/control shift	While drawing, toggles between draw perpendicular and parallel to reference plane. Toggles Insert option on/off.
Bezier Spline **Spline Through Points** **Spline**	command/control shift option/alt	While drawing, toggles between draw perpendicular and parallel to reference plane. Toggles insert option on/off. Spline tools only: toggles end/smooth spline point.
Arc 1 **Arc 2** **Arc 3**	command/control shift	While drawing, changes arc direction. Toggles insert option on/off.
Arc 4	shift	Toggles insert option on/off.
Reshape	command/control shift	While pushing/pulling a face, toggles between perpendicular to reference plane and perpendicular to surface. Toggles keep edges option on/off.
Tool	Key	Action
Offset Outline	shift	Toggles insert option on/off.
Offset Segment	command/control shift	Toggles extend to boundary option. Toggles insert option on/off.
Extrusion **Point Extrude** **3D Wall**	command/control	While extruding, toggles between perpendicular to reference plane and perpendicular to surface.
Move	command/control shift option/alt	Toggles between move perpendicular and parallel to reference plane. Toggles between allow and disallow snapping to original. Toggles between most recently selected copy mode and self.
Rotate **Uniform Scale** **Independent Scale** **Mirror**	shift option/alt	Toggles between allow and disallow snapping to original. Toggles between most recently selected copy mode and self.
Measure Distance	command/control	Toggles measure perpendicular on/off.
Measure Arc	command/control	While defining arc, toggles angle direction.

File Menu

This menu consists of six sections, as shown. The first contains commands that open projects, including **layout** projects, where presentation drawings may be composed. **Layouts** are discussed in detail in the section after the next. All the work in **form•Z** is organized in projects. You can have any number of projects opened simultaneously but only one can be active at a time. Each project may have any number of windows open.



The File menu.

The second group contains standard items for closing and saving.

The third section contains the single item **Project Settings...**, which is discussed in detail in a separate section.

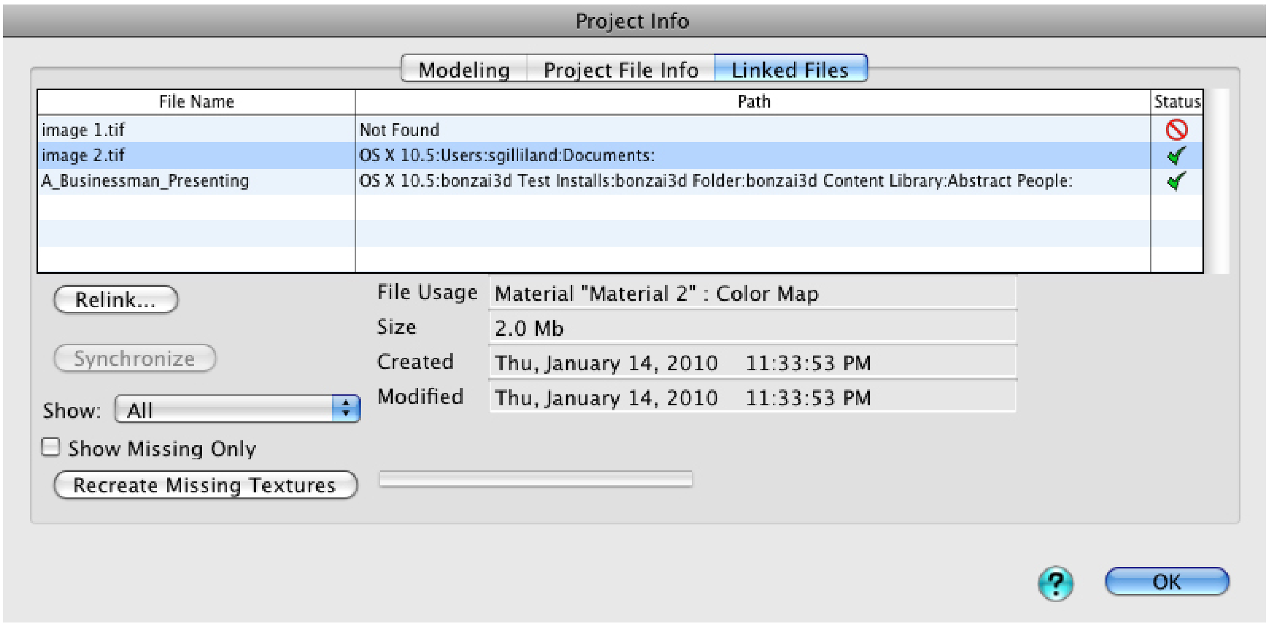
The third section contains the item **Project Settings...** which is discussed in detail in a separate section. The **Project Info...** command invokes a dialog containing information about the project. This information is organized in 3 tabs: The **Modeling** tab contains numeric summary information about the topologies of all the objects in the project, the **Project File Info** tab contains information about the project, and the **Linked Files** tab contains information about linked files, if any. More specifically, the **Linked Files** tab shows a list of linked files used in the project, which are currently textures that may be used in renderings or component files.

The list consists of three columns, as follows:

File Name: This column shows the file name of the linked files.

Path: This column shows the path on disk of the linked files. If the file is missing, it will read **Not Found**.

Status: This column shows the status of the linked files. If the file is missing, an exclamation point inside a yellow triangle will be displayed. If the linked file is in good shape, a green checkmark is displayed.



File Name	Path	Status
image 1.tif	Not Found	⊘
image 2.tif	OS X 10.5:Users:sgilliland:Documents:	✓
A_Businessman_Presenting	OS X 10.5:bonzai3d Test Installs:bonzai3d Folder:bonzai3d Content Library:Abstract People:	✓

File Usage	Material "Material 2" : Color Map
Size	2.0 Mb
Created	Thu, January 14, 2010 11:33:53 PM
Modified	Thu, January 14, 2010 11:33:53 PM

The list of linked files if complemented by a number of commands and options at the lower end of the dialog, as follows:

Relink...: This button is used to fix a missing file or to link to a different file.

Show: This menu determines the types of linked files to show in the list. For example, if there are two or more renderers installed that use linked texture maps, they will each be shown here. By default, all linked file types are shown.

Show Missing Only: When this option is on, only missing linked files will be shown in the list. By default, all linked files are shown.

File Usage: This information field shows how the currently selected linked file is used in **form•Z**.

Size: This information field shows the file size of selected linked file.

Created: This information field shows the date and time that the currently selected linked file was created.

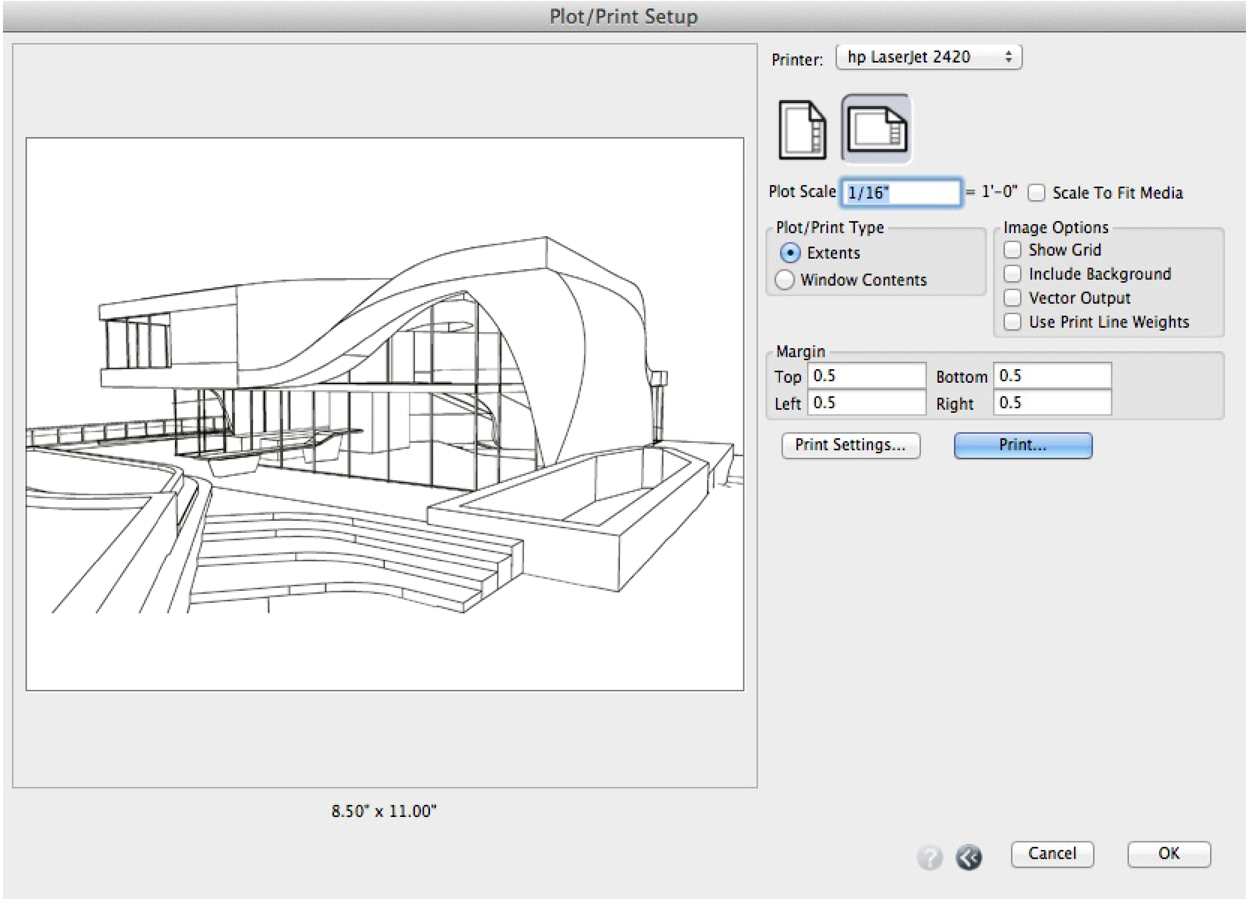
Modified: This information field shows the date and time that the currently selected linked file was last modified.

The fourth section handles importing and exporting. The formats available in **form•Z** are discussed in a separate section.

The fifth and sixth sections contain standard file viewing and printing commands.

Prints produced by **form•Z** are based on what is displayed in the active modeling window. The contents of the active window are printed in their current view and according to their current type of display, which may be a line drawing or a shaded rendering.

The print command invokes the **Plot/Print Setup** dialog where print parameters are set and the contents of the active modeling window can be sent to a printer. The left portion of the dialog contains a preview of a sheet to be printed. See dialog below.



Plot/Print Setup

Printer: hp LaserJet 2420

Plot Scale 1/16" = 1'-0" ☐ Scale To Fit Media

Plot/Print Type
● Extents
○ Window Contents

Image Options
☐ Show Grid
☐ Include Background
☐ Vector Output
☐ Use Print Line Weights

Margin
Top 0.5
Bottom 0.5
Left 0.5
Right 0.5

8.50" x 11.00"

The form•Z Plot/Print Setup Dialog.

The right side of the dialog contains options for controlling the printing.

Printer: This menu contains the list of printers that are available on the computer. The printer selected from the menu is the active printer and the destination for printing.

Orientation: The icons control the orientation of the page **Portrait** or **Landscape**.

Scale to Fit Media: When selected the sheet is scaled to fit on the page.

Scale: When selected the sheet is scaled to the specified scale. If the scale causes the sheet to exceed the size of a single page, it will be printed on multiple pages. In this case the preview shows lines on the sheet to indicate how the sheet will be split into multiple pages.

Plot/Print Type: This section controls whether **form•Z** prints what is in the file, or what is in the current modeling window.

Extents: When this option is selected, all the objects or elements in the project are printed regardless of what is visible in the window.

Window Contents: When selected, only the objects or elements that are visible in the window are printed. This option prints the window in a "what you see is what you get" fashion.

Image Options: This section controls additional printing options.

> **Show Grid**: This option controls whether the reference grid will be included in the print. Note that whether or not the grid is printed is independent from whether it is currently displayed in the window.
>
> **Include Background**: When this option is selected, the background of the plotted/printed image is filled with the background color. This option is most useful when using color printers. It is off by default.
>
> **Vector Output**: With this option the line work and text are printed as resolution independent geometry to printers and PDF files.
>
> **Use Print Line Weights** When this option is selected, the print line weight specified in the line weight parameters is used for printing.

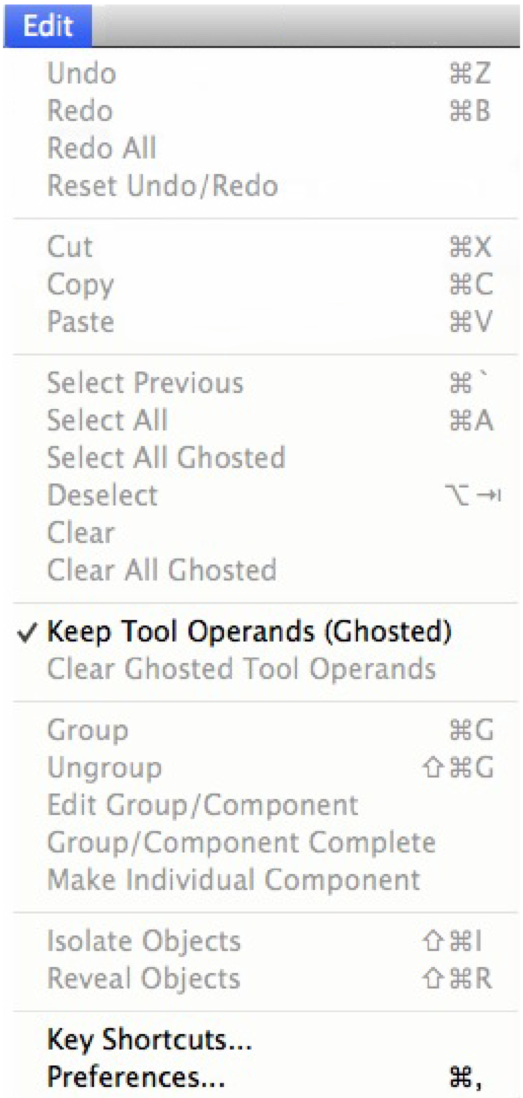
Margin: Defines the border around the physical edge of the paper in which nothing is printed. The margin setting can be used to limit the printing for aesthetic reasons but also it is important to note that most printers cannot print to the edge of the paper so you should select a margin that reflects the printer's characteristics. This is the same parameter available for the layout and is provided here as well for convenience.

Print Settings: This button invokes the system specific print settings dialog where a number of printer specific parameters can be set. If the printer supports different paper sizes, the desired paper is selected in this dialog.

Print: This button invokes the system specific print interface to send the document to the printer or PDF file.

Edit Menu

This menu consists of seven groups of mostly standard commands.



The Edit menu.

The first group contains undo and redo commands which are affected by settings in the **Preferences** dialog, **Project: Undo** section. The undos are unlimited by default and may or may not be saved with projects. They are not by default. By default they are also reset every time a project is saved, but this is optional.

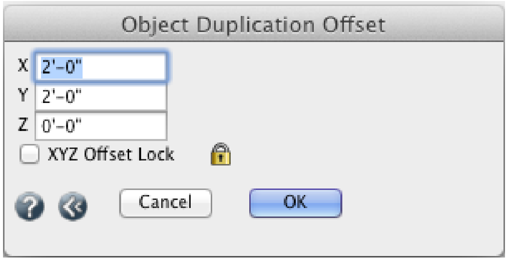
The second group contains the standard **Cut**, **Copy**, **Paste**, and **Duplicate** commands. If you select the latter while pressing the option key, the **Object Duplication Offset** dialog is invoked, where X, Y, and Z offset values can entered. The same dialog can be invoked directly with the **Duplication Offset...** command, found at the end of this group.

The third group contains commands for selecting and deselecting and for global deletions (clearing). Recall that **form•Z** objects can be active or ghosted and there are separate commands for dealing with each category.

The fourth group contains items that control the status of objects, after operations are applied to them. You can instruct the program to **Ghost**, **Delete**, or **Keep** the operand objects of an operation. Also in this group is **Apply To All Operands**, which applies when parts of objects are used in an operation. For example, a new extrusion is generated from the face of an object. By default, the object on which the face is excluded from the above options and it is kept as it is (it is neither ghosted nor deleted). However, if **Apply To All Operands** is on, the **Ghost**, **Delete**, or **Keep** options will apply to this object as well.

The next item in this group is **Clear Ghosted Operands**. There are two ways in which objects can be ghosted in **form•Z**. The first is as a result of an operation applied to them. The second is by using the **Ghost** tool and explicitly ghosting an object. This command will clear (delete) only the ghosted objects that resulted from operations.

Place Derivatives On Active Layer and **Derivatives Use Current Material** are new options in the **Edit** menu. These control what layers and materials are applied to objects that are derived from other objects (as with the **Extrusion** or **Revolve** tool, for example). When these options are enabled, the current material or layer is used (the default action in prior versions of **form•Z**). When not enabled, the layer of material of the source object is used.



X 2'-0"
Y 2'-0"
Z 0'-0"
☐ XYZ Offset Lock

The Object Duplication Offset dialog.

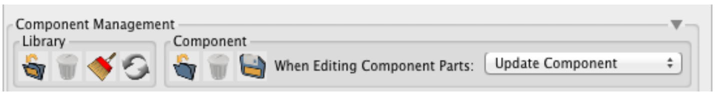
The fifth group contains commands that relate to picking. When **Click And Drag** is checked, you can execute a move by simply clicking and dragging rather than using the **Move** tool.

When **2 Click Face/Outline Selection** is checked, faces and outlines are picked with two clicks. When **Selection Preview** is checked, entities are highlighted when the mouse cursor is placed on them, indicating that they will be picked when the mouse is clicked.

The sixth group contains two commands: **Unlock Groups** and **Unlock Components**. When these are on the members (objects) of the groups or components and their parts (faces, segments, points, etc.) can be picked by a **Pick** tool or by any other tool that may post pick them to execute an operation. In such a case groups can still be post picked as groups by tools that expect a group. When these items are off, which is the default, groups or components can only be picked as groups or components.

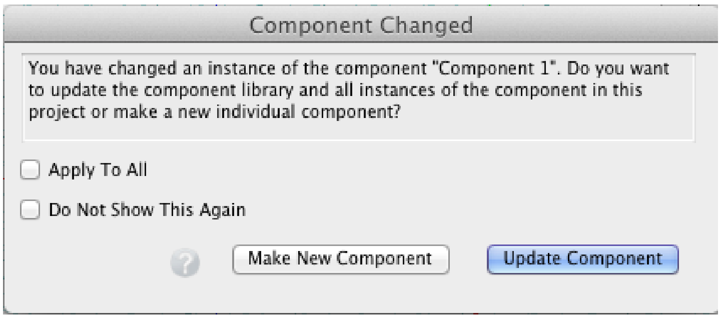
When making changes to a component, one of three options may apply: **Update Component**, **Make New Component**, or **Ask**, which is selected from the **Component Manager** palette. When **Ask** is on, every time you make a change to a component the **Component Changed** prompt is issued, offering the above options.

The seventh group contains commands relating to grouping and components. The **Group** and **Ungroup** items function the same as the **Group** and **Ungroup** tools, when used with the prepick selection method.



When Editing Component Parts: Update Component

Part of the Component Manager Palette.



You have changed an instance of the component "Component 1". Do you want to update the component library and all instances of the component in this project or make a new individual component?

☐ Apply To All

☐ Do Not Show This Again

The Component Changed Warning Dialog.

Once objects are grouped they can only be manipulated as a group and the individual objects cannot be accessed. The **Edit Group/Component** command provides for a way to edit the objects and the composition of a group or component. When selected, all of the objects in the model that are not a part of the group become temporarily ghosted. The **Objects** palette only shows the objects that are in the group. The bounding box of the group is shown with a dashed line. Objects in the group can now be selected, modified and deleted. Any new objects that are drawn become a part of the group. Selecting the **Edit Group Complete** command terminates the editing of the group. The rest of the model is revealed (unghosted) and the **Objects** palette again displays the entire model. Recall that grouping is hierarchical. That is, when two groups are themselves grouped, the hierarchy is retained forming nested groups (or groups within groups). **Group** editing functions on nested groups. That is, while editing a group, **Edit Group/Component** can be selected again on a nested group to edit its contents. When editing nested groups, **Edit Group Complete** must be selected to terminate editing for each level of nesting.

When the group that is edited is a component group, all of the instances of the component are updated when the editing is completed. The instances remain visible for reference and they are shown with a dashed bounding box. Additional on screen controls are displayed that represent the origin and coordinate system of the content definition.

Note that the project cannot be saved or closed while group editing is in progress. During group editing, the **Undo** command cannot undo beyond the point where group editing began. Once group editing is complete, a single undo will undo all of the editing performed while editing the group.

Make Individual Component is the last item in the seventh group. There are times when it is desirable to edit placed component without changing all of the instances placed in the project. **Make Individual Component** makes the selected component unique by creating a new component definition in the project for the selected instances. That is, the definition of the component is duplicated and the selected instances are adjusted to use the new component definition.

The eighth group contains the **Isolate Objects** and **Reveal Objects** commands.

When working on a complex model there are times when it is desirable to isolate a small set of objects for working on a detail of the model. The **Isolate Object** menu item isolates the currently selected objects by temporarily ghosting the remaining objects in the scene. This can be applied repeatedly to further reduce the number of visible objects. The **Reveal Object** menu item unghosts all of the objects that were previously ghosted by the Isolate command.

Note that the project cannot be saved or closed while objects are isolated. Also note that although **Isolate** can be used multiple times to reduce the number of workable objects, Reveal only needs to be used once to display all of the objects.

The ninth group contains the **Key Shortcuts...** and **Preferences...** commands. Each of these is discussed in a separate section.

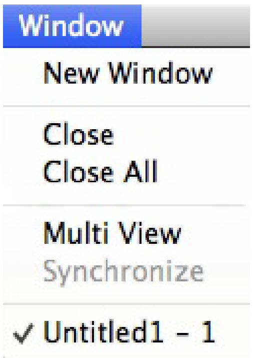
Window Menu

It consists of several groups, the last of which is simply a list of the names of the currently open windows.

The first group has a single command for opening a new window for the currently active project.

The second group contains commands for closing windows, one at a time or all at once.

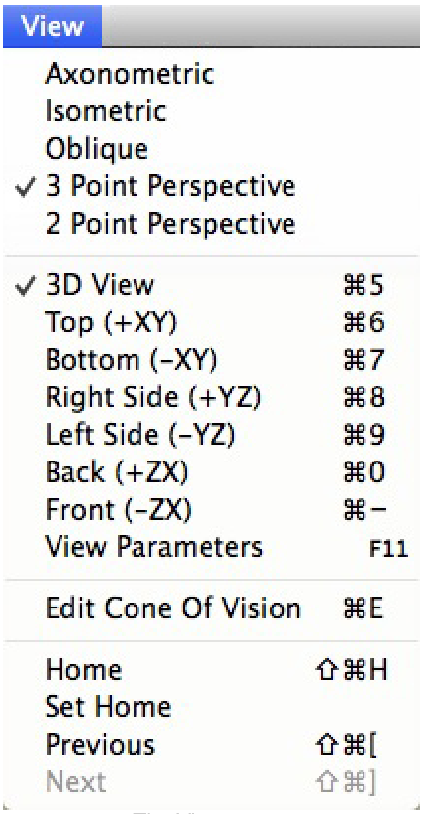
The third group allows you to switch to a multi-window setup. That is, the screen is subdivided in four quadrants containing XY, YZ, and ZX projections and a 3D view, simultaneously, as shown. You make any one of these active by clicking on it. As you may work on each of these quadrants, you may change their scale or pan. When this happens you can use the **Synchronize** command to again line them all up. See example of a **Multi View** setup below.



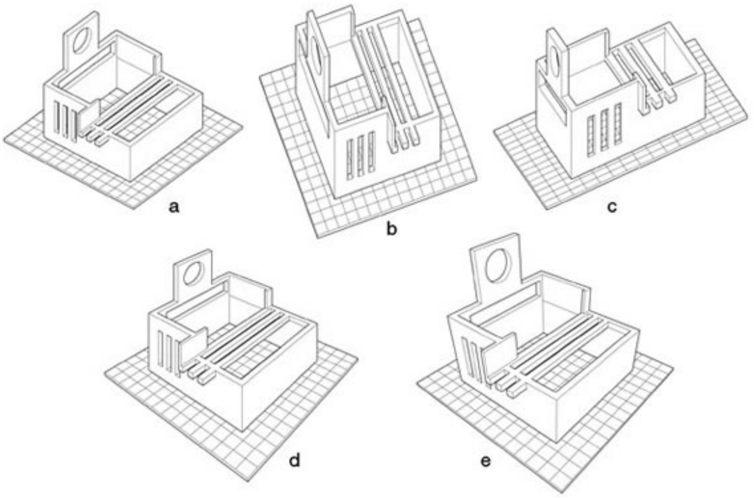
The Window menu.

View Menu

This menu consists of several groups of commands. The first contains different types of 3D views. See illustrations.



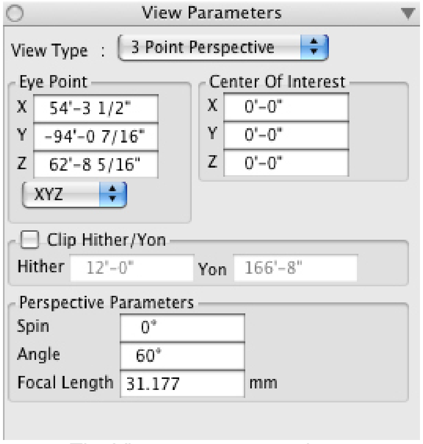
The View menu.



form•Z view types (a) axonometric, (b) isometric (c) oblique (d) 3 Point Perspective, and (a) 2 point perspective

The next group contains different views, namely a 3D view and six orthographic projections. All these are also available in the **Navigation** tool palette on the top of the screen.

View Parameters invokes the **View Parameters** palette. The same palette can also be invoked from the **Palettes** menu. It both reflects methods available in the menu and offers additional methods for specifying views.



View Parameters

View Type : 3 Point Perspective

Eye Point
X 54'-3 1/2"
Y -94'-0 7/16"
Z 62'-8 5/16"
XYZ

Center Of Interest
X 0'-0"
Y 0'-0"
Z 0'-0"

☐ Clip Hither/Yon
Hither 12'-0" Yon 166'-8"

Perspective Parameters
Spin 0°
Angle 60°
Focal Length 31.177 mm

The View parameters palette.

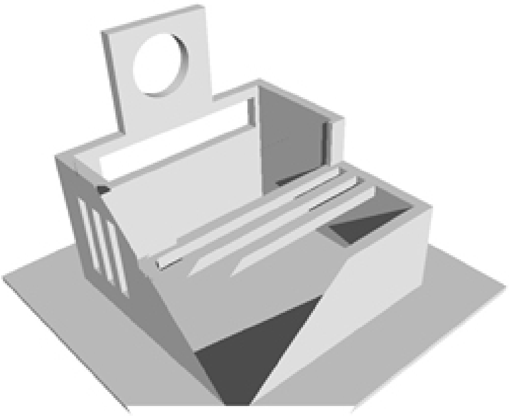
View Type: This popup menu contains the 3D types also found in the menu.

Eye Point and Center Of Interest: The coordinate values entered in these fields specify the position of the two key points of a line of sight.

XYZ and Polar: These two items selectable from the popup menu specify the type of coordinates used.

Clip Hither/Yon: The hither and yon are two planes perpendicular to the line of sight that can be used to clip a scene for viewing purposes, as shown in the example. In other words the clipping does not affect the models involved in the scene permanently but is only applied temporarily for viewing purposes. When this option is on, clipping is applied and the position of the clipping are specified by the values entered in the **Hither** and **Yon** numeric fields. See examples of clipping below.

Perspective Parameters: This group of three numeric fields specifies values that define a perspective view numerically.



The next group in the **Views** menu contains a single command, namely, **Edit Cone of Vision**. The cone of vision is discussed in a separate section.

The last group contains four menu items, as follows:

Home and **Set Home**

A clipped view.

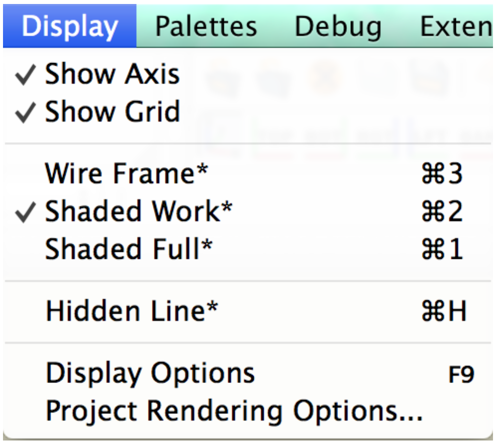
The home view is a view that is frequently used or a good place to view the entire model. The home view by default is the initial view that a project is created with. When the **Home** menu item is selected, the view is reset to the home view. To change the home view, use any of the view tools to navigate to the desired home view and then select the Set Home item from the View menu. Note that, when opening projects created in **bonzai3d** prior to v. 2.0 or any **form•Z** project, the current view becomes the home view.

Previous and **Next**

The **Previous** item changes the view to the last view. That is, to the view prior to the most recent navigation or other command that changed the view. You can recall previous views all the way back to the point at which the project was opened or created. Once you have selected a previous view, you can return to the view prior to the selection of **Previous** by selecting **Next**. **Previous** and **Next** can be used to roll through the range of recently used views. Note that as soon as the view is changed, the **Next** item is dimmed.

Display Menu

This menu, in its basic plain form, consists of commands that control the display on the screen. Most of these commands are also available as tool icons in the **Display** tool palette, at the top of the screen. When the **RenderZone** plugin is installed, additional commands appear in the menu, as shown to the right.



The two commands in the first group allow you to turn on/off the display of the reference plane grid and axes.

The remaining groups contain rendering methods. When the **RenderZone** plugin is installed, it will appear here as well. All these commands have an asterisk (*) at their end, which signifies that if you press ***option*** (Macintosh) or ***alt*** (Windows) when you click on them, a dialog with options affecting them will be invoked.

The next group contains commands that relate to **Network Rendering**, which are discussed in a separate section.

The last three groups contain commands that invoke palettes or dialogs.

Display Options: invokes the **Display Options** palette, which can also be invoked from the **Palettes** menu.

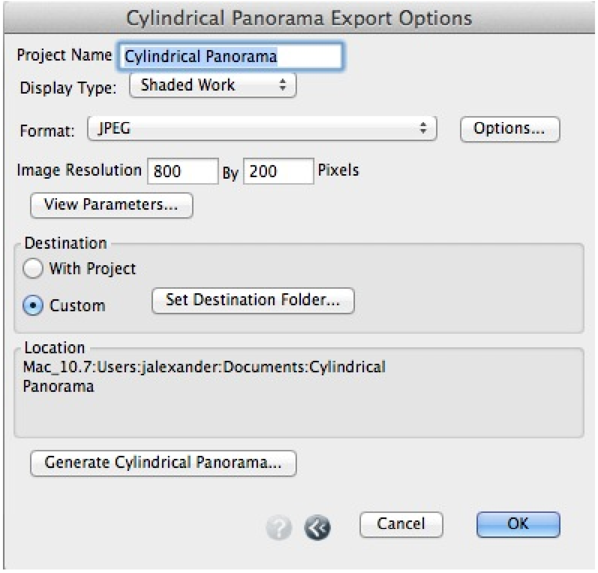
Project Rendering Options...: invokes the **Project Rendering Options** dialog.

Render Area Rectangle: is present when the **RenderZone** plugin is enabled, and allows for rendering a user defined sub-area of the modeling window.

Generate Cylindrical Panorama

This option will generate a panoramic rendering that essentially wraps the inside of an imaginary cylinder with a single image of your entire scene. These renderings can be used as environment maps for rendering other scenes or viewed in other 3rd party viewers.

The **Cylindrical Panorama Export Options** dialog is shown at right.


Cylindrical Panorama Export Options

Project Name: Cylindrical Panorama

Display Type: Shaded Work

Format: JPEG

Image Resolution 800 By 200 Pixels

Destination

○ With Project

● Custom

Location

Mac_10.7:Users:jalexander:Documents:Cylindrical Panorama

The Cylindrical Panorama Export Options.

Project Name: Here you can name your panoramic image file.

Display Type: this setting determines what render type will be used when the image is generated.

Format: this setting determines what file format will be used when the image file is saved.

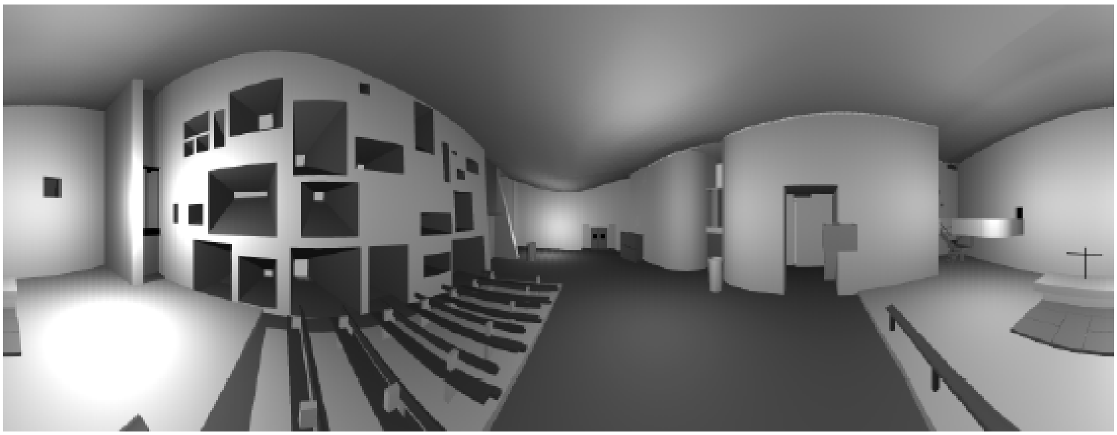
Image Resolution: this setting determines the actual size of the image, in pixels.

View Parameters: this invokes the View Parameters dialog that is used for generating the **Cylindrical Panorama**. It is the same as the standard **View Parameters** described under the **View Menu** entry. It defaults to using the **Origin** for the **Eye Point**, but can be moved as needed using this dialog. The view type setting in this dialog can only be set to **Panoramic**.

Destination: this setting determines where the image file is saved after it has finished rendering. You can save it to the same folder the project is in or specify an alternate save location using Set Destination Folder.

Location: this displays the path that will be used when saving the image file after it has been rendered.

Generate Cylindrical Panorama: this button executes the process of rendering and saving the image.



An Example of a Cylindrical Panorama.

Generate Cubic Panorama

This option will generate a set of files that make up an interactive **Cubic Panorama**. This is a type of image that is constructed of six individual square images that are displayed as the insides of a cube.

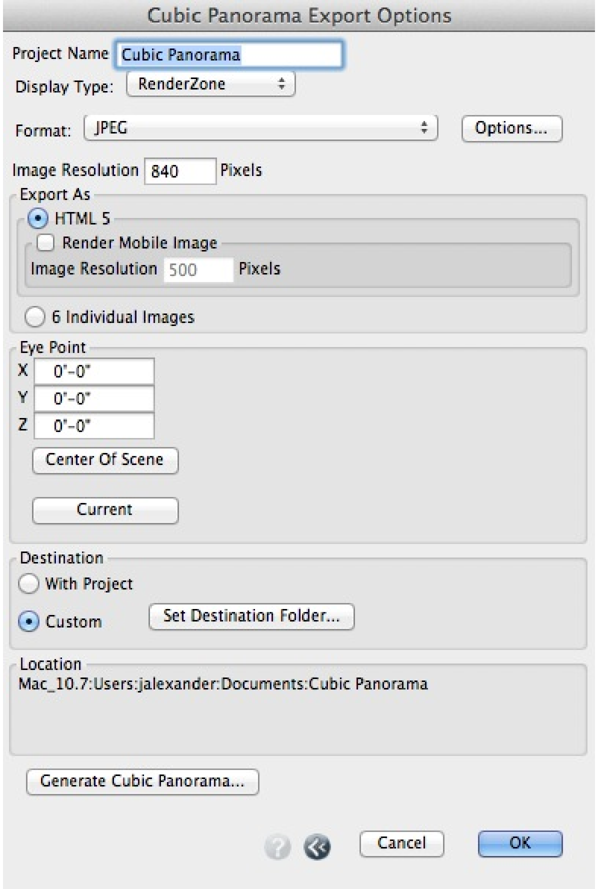
The **Eye Point** for the **Cubic Panorama** is by default located at the file's origin. When viewed in a **HTML 5** compatible viewer, the image can be moved around the center in real time by clicking and dragging in the display window. The options in the **Cubic Panorama Export** share some of those from the **Cylindrical Panorama Export Options**, discussed in the previous section. Options specific to **Cubic Panoramas** are described below.

Export As: this setting determines the final format of the exported **Cubic Panorama**.

HTML 5: creates all of the files needed to view the **Cubic Panorama** in Safari or another capable browser.

Render Mobile Image: makes a file that can be viewed on handheld devices.

6 Individual Images: makes the same images it would for the **HTML 5** version, however it does not create a file that can be directly viewed. This option is intended to allow the user to create images to import into a 3rd party application for assembly and creating an interactive file.



Cubic Panorama Export Options
Options...
Center Of Scene
Current
Set Destination Folder...
Generate Cubic Panorama...
Cancel
OK

Project Name: Cubic Panorama
Display Type: RenderZone
Format: JPEG
Image Resolution 840 Pixels
Export As
● HTML 5
☐ Render Mobile Image
Image Resolution 500 Pixels
○ 6 Individual Images
Eye Point
X 0'-0"
Y 0'-0"
Z 0'-0"
Destination
○ With Project
● Custom
Location
Mac_10.7:Users:jalexander:Documents:Cubic Panorama

The Cubic Panorama Export Options.

Eye Point: this determines the vantage point for the **Cubic Panorama**. The file's origin used by default. If another location is desired, the X,Y, and Z values can be typed in using the file's units. The **Center of Scene** button is useful when your scene is not centered around the origin. This will automatically move the **Eye Point** to a location that is the centroid of the bounds of your scene. The **Current** button is useful when you want to use the **Eye Point** of the active view.

An Example of a Cubic Panorama.

Generate Object 360

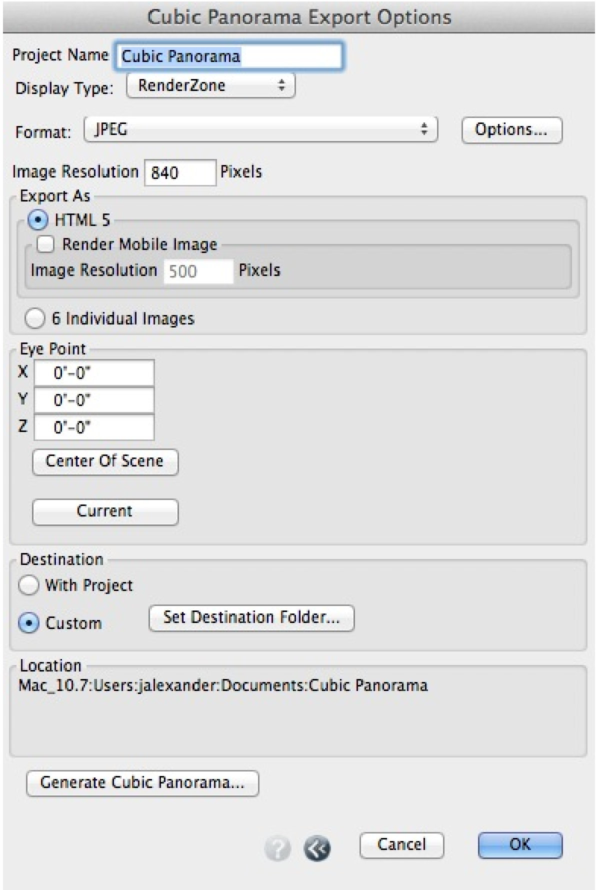
This option generates an **Object 360** file. This is a file that has the objects for viewing located at the origin of the file, and dragging the cursor in the window will rotate the object in any direction. This allows a client or customer to examine a model from any angle in order to evaluate a design. Some of the options found in the **Object 360 Export Options** dialog are shared with the **Cylindrical Panorama Export Options** dialog. The ones specific to **Object 360** are discussed below.

Export as: this setting determines the type of output for the **Object 360** file.

HTML 5: creates a set of files that will allow viewing in Safari or another capable browser.

Images: this creates a series of images but does not assemble them automatically and make a viewing file. These images are intended to be imported into a third party application for creating 360 degree interactive movies.

Move lights with view: When this option is on, all lights are rotated with the eye point around the center of the scene. When the object movie is played back, this gives the impression of the objects moving, while the lights stay fixed. In other words, the hotspots on curved and shiny objects move across the objects. When this option is off, the hotspots stay at the same positions.



Cubic Panorama Export Options

Project Name: Cubic Panorama

Display Type: RenderZone

Format: JPEG

Image Resolution 840 Pixels

Export As

● HTML 5

☐ Render Mobile Image

Image Resolution 500 Pixels

○ 6 Individual Images

Eye Point

X 0'-0"

Y 0'-0"

Z 0'-0"

Destination

○ With Project

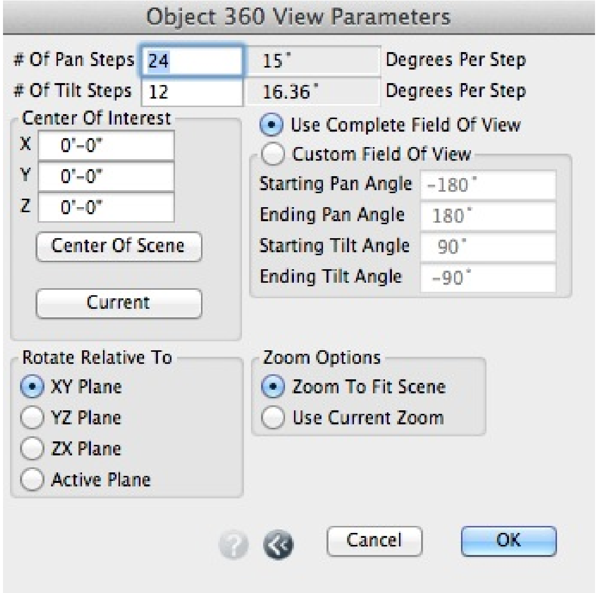
● Custom

Location

Mac_10.7:Users:jalexander:Documents:Cubic Panorama

The Object 360 Export Options.

View Parameters: Clicking on this button invokes the **View Parameters** dialog shown to the right. It contains the parameters that affect the generation of an object movie. An object movie consists of individual images rendered by looking at the scene from a sphere around the scene. To generate the images the view is rotated a number of times horizontally around the sphere's vertical axis. This is called panning. After the horizontal rotations, the view is rotated vertically about the sphere's horizontal axis, which is referred to as tilting. A new set of panned images is then taken from the new tilted position. This is repeated until all rotations are completed. In order to render a complete movie of a scene, the view starts at the north pole of the sphere, looking straight down the vertical axis. After each set of horizontal rotations covering 360 degrees, the vertical tilt rotates the view a number of steps for a total of 180 degrees, until the last set of images is taken from the south pole looking straight up the vertical axis. This process is illustrated below.



Object 360 View Parameters

Of Pan Steps: 24 — 15° Degrees Per Step

Of Tilt Steps: 12 — 16.36° Degrees Per Step

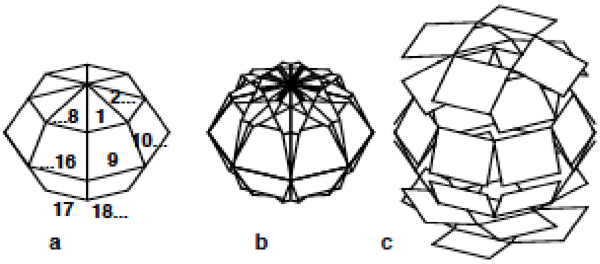
Center Of Interest
X: 0'-0"
Y: 0'-0"
Z: 0'-0"

● Use Complete Field Of View
○ Custom Field Of View
Starting Pan Angle: -180°
Ending Pan Angle: 180°
Starting Tilt Angle: 90°
Ending Tilt Angle: -90°

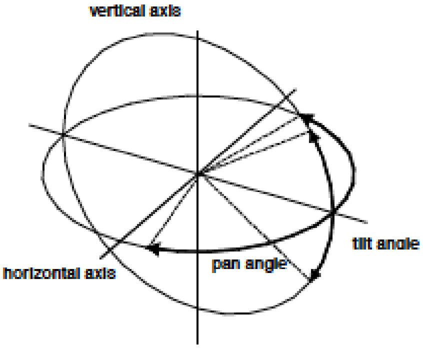
Rotate Relative To
● XY Plane
○ YZ Plane
○ ZX Plane
○ Active Plane

Zoom Options
● Zoom To Fit Scene
○ Use Current Zoom

The Object 360 View Parameters Dialog.



Object Movie with (a) 8 x 8 sphere;
(b) the images, and (c) exploded view



The Pan and Tilt angles.

# Of Pan Steps: This sets how many times the view is rotated around the vertical axis.

# Of Tilt Steps: This sets how many times the view is rotated around the horizontal axis.

Center Of Interest: The coordinates in these X, Y, and Z fields indicate the center of interest for each image of the object movie.

Center of Scene: Clicking on this button causes the coordinate values of the center of the scene's bounding box to be entered in the **Center Of** window to be entered in the **Center Of Interest** fields.

Rotate Relative To: The vertical and horizontal axes of the sphere are set relative to the selected reference plane, as follows:

XY Plane: the vertical axis is the world Z axis and the horizontal axis is the world Y axis.

YZ Plane: the vertical axis is the world X axis and the horizontal axis is the world Z axis.

ZX plane: the vertical axis is the world Y axis and the horizontal axis is the world X axis.
Active Plane: vertical axis is the Z axis and horizontal axis is the Y axis of the active reference plane, which may be an arbitrary plane or one of the Cartesian (XY, YZ or ZX) planes.

Use Complete Field Of View: When this option is selected, the object movie is generated with a 360 degree pan angle and a 180 degree tilt angle, covering the entire scene.

Custom Field Of View: When this option is selected, start and end angles can be entered for pan and tilt. Note that the pan angle is measured relative to the axis which is perpendicular to the horizontal axis of the sphere, whereas the tilt angle is measured relative to the equator of the sphere.

Zoom To Fit Scene: When this option is selected, the view for all renderings is adjusted so that all objects in the scene will be visible in all images.

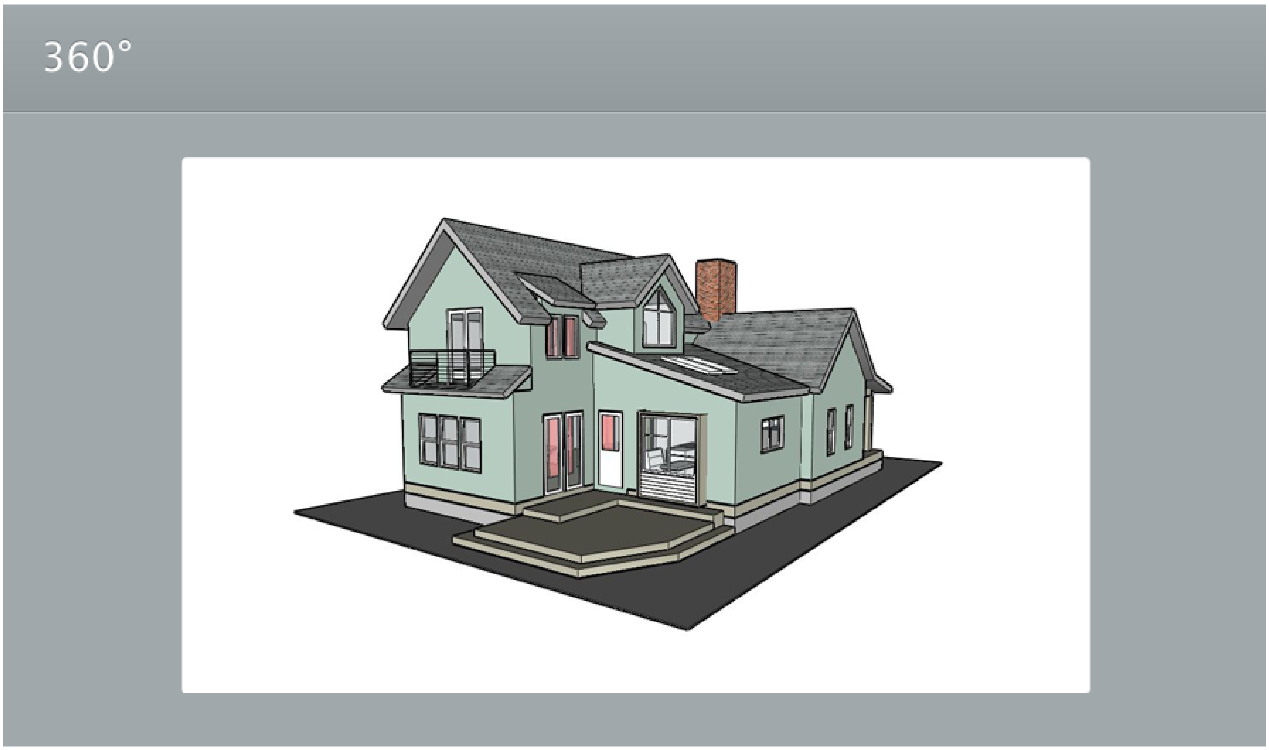
Use Current Zoom: When this option is selected, the zoom factor of the current view in the active window is used for all renderings.

Generate Animation: this command generates multi-frame animations that can be played in sequence.

Play Animation: is a feature that allows playing **form•Z** animations from directly within **form•Z**.

Image Options…: invokes the **Image Options** dialog. The content of these are discussed in other sections of this manual.

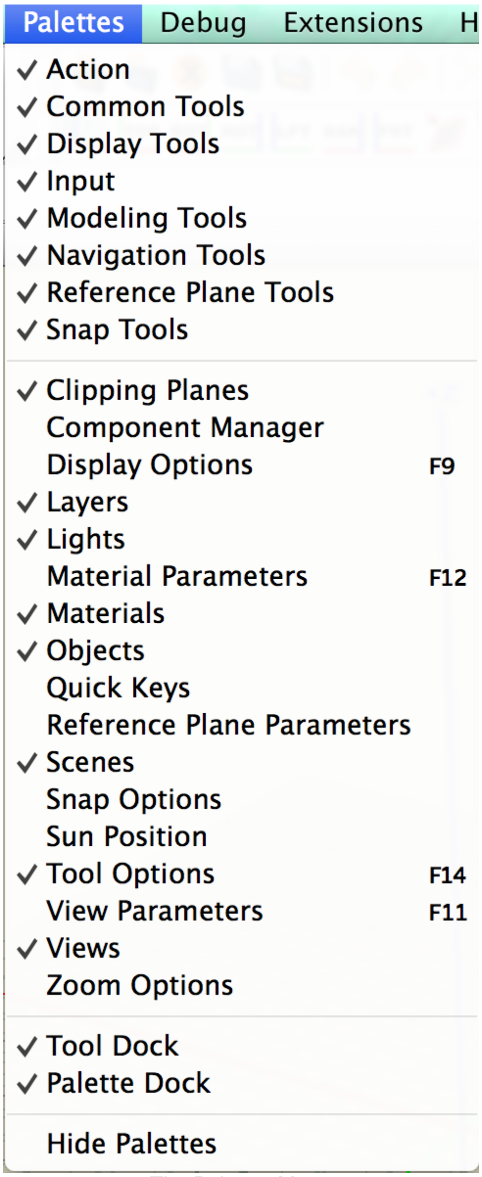
For a more detailed discussion of the display modes, the rendering options and image parameters, see sections **Display methods**, **Project level rendering options**, and **Setting image parameters** later in this manual.



An Example of an Object 360 file as viewed in Safari.

Palettes Menu

This menu consists of several groups with commands that mostly invoke and hide palettes and dialogs. Most of the palettes are open by default, when **form•Z** is launched. When they are, a check mark is displayed in front of their names. Clicking on an item with a check mark causes the check mark to disappear and the respective palette to hide. The same can be done by clicking on the close button (upper left corner) of the palette.



The Palettes Menu

The first group contains commands that invoke/hide the tool palettes of **form•Z**. The position of these palettes is shown in the introductory section (**Layout and Interface**) of this manual.

The second group contains the palettes of different **form•Z** features that open either in the dock on the right side of the screen or somewhere else in the project window.

Clipping Planes: Invokes the **Clipping Planes** palette. Traits associated with **List** type palettes are discussed below.

Component Manager: Invokes the **Component Manager**. The **Component Manager** is discussed in detail in the **Component Manager** palette section.

Display Options: Invokes the **Display Options** palette. Each display mode available in the palette are discussed in detail under each type of display. The settings in each are discussed in detail in the **Display Methods** section.

Layers, Lights, Objects, Scenes, Views and the previously mentioned **Clipping Planes** and **Custom Reference Plane** palettes: These are more specifically called ***list palettes*** as they contain listed of items and displays their attributes. These palettes are divided into columns containing attributes such as **Name**, **Selection**, **Visibility**, **Snapability**, etc. Placing the mouse cursor on the title bar invokes a hint that tells you what the column is.

Objects and groups are listed automatically as they are generated. Similarly for the reference planes. Entries in the palette are generated as custom reference planes are created. For all the above palettes, new entries can be generated by right-clicking in the palette to invoke its context menu and then selecting **New**. Other commands can also be selected from the context menu, when relevant. The context menu can also be invoked by clicking on the green **Options** (⌄) button on the right of the palette's title bar. New entries can also be generated by clicking on the green **New** (⊕) button located next to the **Options** button.

Several of the list palettes, **Scenes**, **Views**, and **Clipping Planes**, have back (◀) and forward (▶) arrows that allow for convenient cycling through the items in the list. You can quickly move from saved view to saved view, for example, without selecting each one individually from the list.

In addition to the above palettes that are open by default, there are four more palettes that can also be invoked from other parts of the program and are discussed in the respective sections, as follows:

Material Parameters: Also invoked from individual materials and discussed in the materials section.

Materials palette: Displays icons of the materials, allows you to select an active material, and to invoke the **Material Parameters** palette for a specific material. This is done by double-clicking on the icon of a material. The **Material Parameter** palette for the active material is also invoked by the

Material Parameters command in this menu. Materials and further details regarding the palette are discussed in the "**Creating and editing materials**" section of this manual.

Quick Keys: Invokes the **Quick Keys** palette. These are discussed in the **Quick Keys** section.

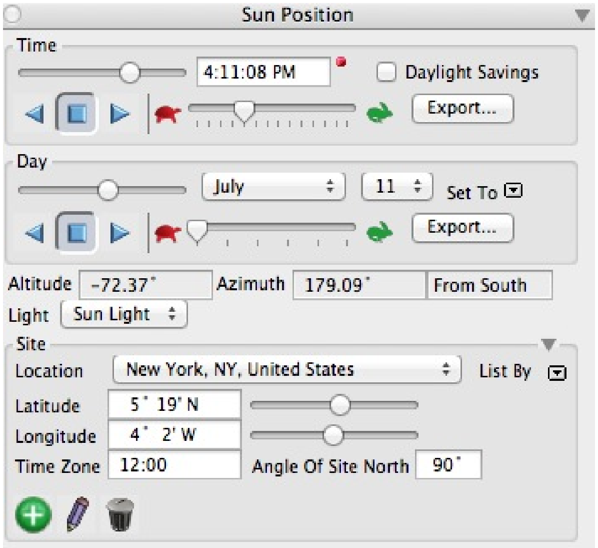
Reference Plane Parameters: Discussed in the "Reference Planes" section.

Select By Criteria: Discussed in the "Select By Criteria" section.

Snap Options: Invokes the **Snap Options** palette, which is discussed in the **Snapping** section.

Sun Position: This item allows you to define the position of the sun light either by specifying the sun's altitude and azimuth, or by selecting the geographic position of the site and the month, day, and time of the desired sun position. The result can also generate and export solar animations.

The **Sun Position** can be animated by either the time of day or the time of year. The Sn position can be defined using the following options:



4:11:08 PM
☐ Daylight Savings
July 11
Altitude -72.37°
Azimuth 179.09° From South
Light Sun Light
Location New York, NY, United States
Latitude 5° 19' N
Longitude 4° 2' W
Time Zone 12:00
Angle Of Site North 90°

The Sun Position palette.

Time: this section is for a 24 hour solar study. You set the time of day with the slider. Use the play and stop buttons to control playback.
You can use the tortoise and hare slider to determine the speed of the animation. The Daylight Savings button may need to be checked if the site you are animating uses this convention. The export button takes you to an animation export dialog that lets you set the display type and other parameters important to exporting animations. More detail on generating and xporting animations can be foud in the **form•Z Animation Manual**.

Day: this set of criteria allows selecting by material, layer, attributes in use, and by object name.

Altitude and Azimuth: this allows setting the sun position by number of degrees.

Light: this dropdown menu will show a list of direct lights in a project file. Choose which light you are animating from this list.

Site: This section offers the ability to specify the location of your project on Earth.

Location: this is a dropdown list of sites that can be sorted and displayed either City or Country.

Latitude/Longitude: these boxes allow entering the co-ordinates of your site, or setting them roughly with a slider.

Time Zone: you set the time zone where your site is located here.

Angle of Site North: This field is used to align the project's coordinate system with Earth's compass directions. By convention, the XY plane is aligned with the Earth's surface and the positive Z axis projects from the Earth's surface into the sky. The **Angle of Site North** field determines the orientation of North on the XY plane. This is the direction of a North arrow typically drawn on architectural plans or maps.

Tool Options: this palette is context sensitive and its content depends on which modeling tool is active. It contains options that affect the active tool and these options are discussed with the respective tool. As such, this is one of the most important palettes in **form•Z**.

View Parameters: Also invoked from the **Views** menu and discussed in that section.

Zoom Options: Invokes the **Zoom Options** palette.

The third group contains two commands:

Tool Dock: turns on/off the dock with the tool palettes on the top of the screen. The tool dock is open by default.

Palette Dock: turns on/off the dock with the palettes on the right of the screen.

The final group contains the single command **Hide Palettes** that turns on/off all the palettes of **form•Z**.

Extensions Menu

The items in the **Extensions** menu are used for controlling which plugins and scripts are enabled and where they are located on your computer's hard disk.

An initial set of plugins and scripts is created during **form•Z** installation. Additional plugins and scripts may be installed as needed.

A ***plugin*** is an extension to **form•Z** that is contained in a **form•Z** plugin file (.fzp). **form•Z** plugin files are binary executable libraries that perform specific tasks. Like the **form•Z** application, **form•Z** plugin files are compiled for specific operating systems and processors, and can not be moved between operating systems. Because they are optimized in this fashion, plugins execute significantly faster than scripts. Plugins also have more access to the internal workings of **form•Z**, hence they often offer features that can not be created with a script. A single **form•Z** plugin file may actually contain a number of plugins. Plugins may also use a number of support files such as **form•Z** resource files (.fzr). These support files are installed in the same directory as the **form•Z** plugin file and must be kept in this location.

The following types of plugins are some of those currently supported:

File translator: Imports/exports data to/from file formats.

Image file translator: Imports/exports image data to/from image formats.

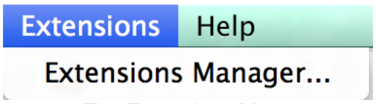
Tool: Adds a new operation to **form•Z**, including a new tool icon to run it from.

Utility: Code that supports a task, which is not a complete tool.

Digitizer: Interfaces to hardware digitizers.

A ***script*** is an extension to **form•Z** that is contained in a **form•Z** script language file (.fsl) or the **form•Z** script binary file (.fsb). The **form•Z** script language file is a text file which contains the script instructions in the **form•Z** script language (.fsl). The **form•Z** script binary file is a binary version of the script that is generated from the text file and allows for more efficient processing of the script. The script files are not platform specific and can be interchanged between different platforms. Scripts are interpreted rather than compiled for a specific system so they do not execute as fast as a plugin. As for the plugins, different types of scripts will be supported.

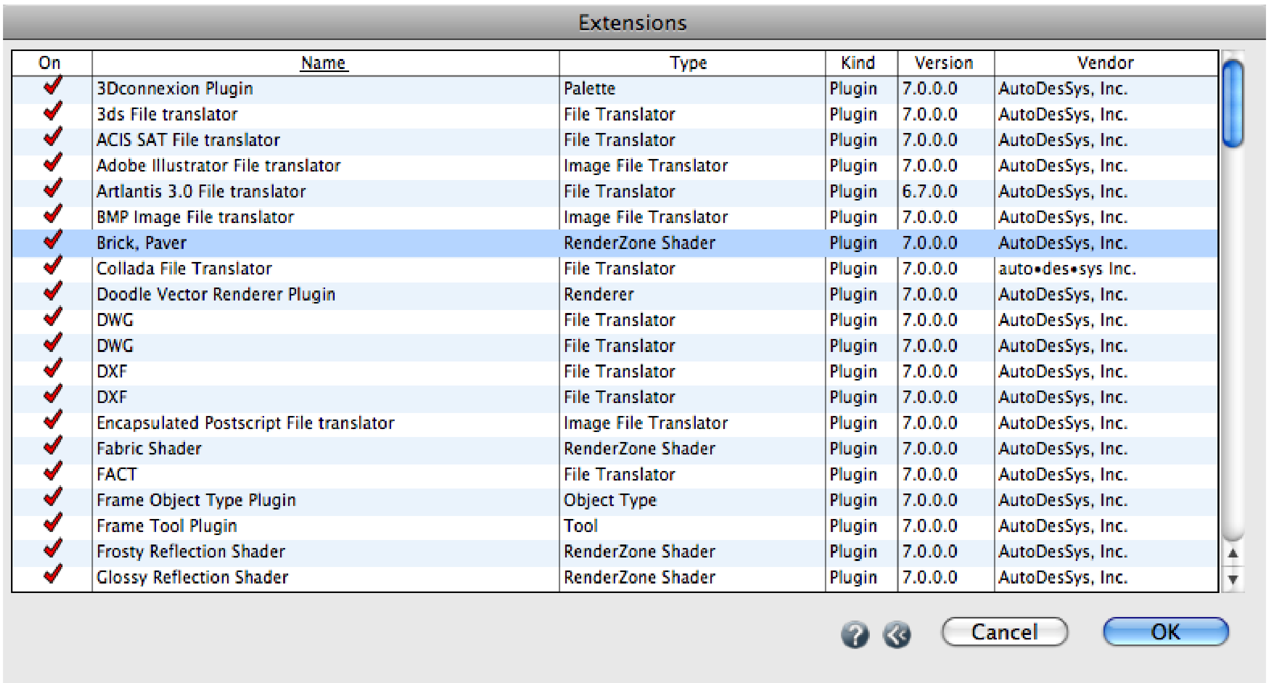
The **Extensions** menu, shown on the right, contains 4 items in the top group. The remainder of the menu may contain additional items or hierarchical menus created by extensions. Selecting one of these items performs the corresponding extension defined action.



The Extensions Menu

Extensions Manager...

This item invokes the **Extensions** dialog, shown below. It is composed of two main sections: the plugins and scripts list which occupies the upper portion of the window, and a number of menus and buttons in the lower portion.



On	Name	Type	Kind	Version	Vendor
✓	3Dconnexion Plugin	Palette	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	3ds File translator	File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	ACIS SAT File translator	File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Adobe Illustrator File translator	Image File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Artlantis 3.0 File translator	File Translator	Plugin	6.7.0.0	AutoDesSys, Inc.
✓	BMP Image File translator	Image File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Brick, Paver	RenderZone Shader	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Collada File Translator	File Translator	Plugin	7.0.0.0	auto•des•sys Inc.
✓	Doodle Vector Renderer Plugin	Renderer	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	DWG	File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	DWG	File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	DXF	File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	DXF	File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Encapsulated Postscript File translator	Image File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Fabric Shader	RenderZone Shader	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	FACT	File Translator	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Frame Object Type Plugin	Object Type	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Frame Tool Plugin	Tool	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Frosty Reflection Shader	RenderZone Shader	Plugin	7.0.0.0	AutoDesSys, Inc.
✓	Glossy Reflection Shader	RenderZone Shader	Plugin	7.0.0.0	AutoDesSys, Inc.

The Extensions dialog.

The **Extensions** dialog displays information about each plugin and script that **form•Z** has knowledge of. Each row of the list represents a single plugin or script. The list contains 6 columns, as follows:

- **On**: This determines if the plugin or script is enabled or disabled. Enabled plugins and scripts will be loaded the next time **form•Z** starts. Disabled plugins and scripts will not be loaded. A check (√) in this column indicates that it is enabled (no mark is shown if it is disabled). The title for this column has a small menu next to it. This menu can be used to turn on or off all the plugins and scripts in the list. Changes to the enabled plugins do not take effect until you restart **form•Z**. If you have changed the “enable” state of any of the plugins or scripts when you exit the dialog with the OK button, you will be given the option to quit **form•Z**.

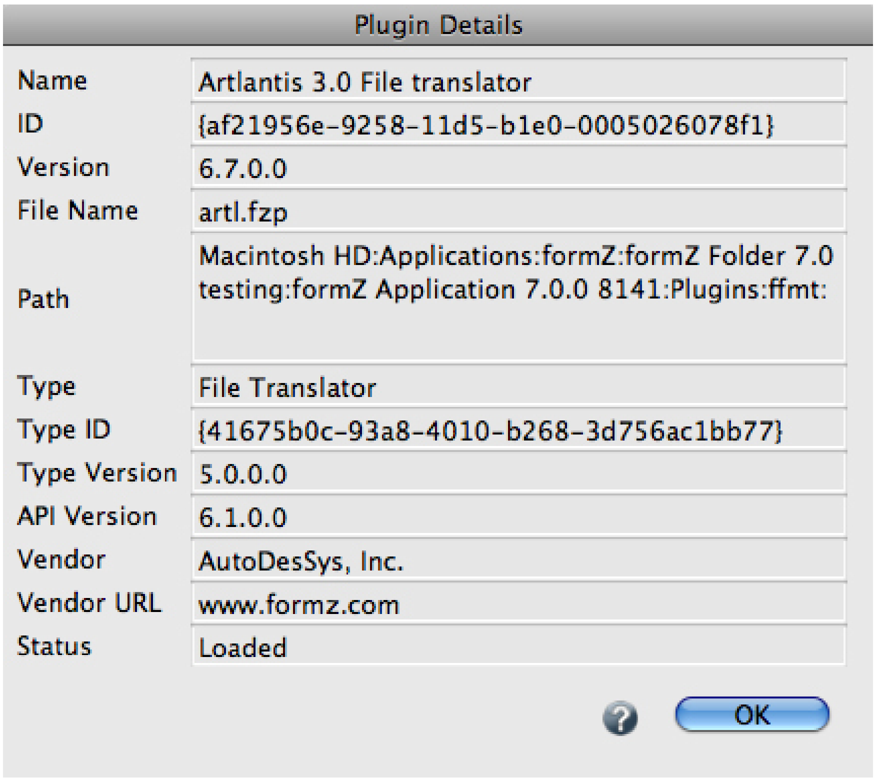
- **Name**: This is the name of the plugin or script. Note that this is not the name of the plugin file, but rather the name that the developer of the plugin or script has chosen.

- **Type**: This is the type of the plugin or script as described above.

- **Kind**: This indicates whether the item is a plugin or a script.

- **Version**: This is the version of the plugin.

- **Vendor**: This is the name of the vendor who developed or distributed the plugin or script. Contact that vendor for updates to the plugin or script and for technical support.



Name	Artlantis 3.0 File translator
ID	{af21956e-9258-11d5-b1e0-0005026078f1}
Version	6.7.0.0
File Name	artl.fzp
Path	Macintosh HD:Applications:formZ:formZ Folder 7.0 testing:formZ Application 7.0.0 8141:Plugins:ffmt:
Type	File Translator
Type ID	{41675b0c-93a8-4010-b268-3d756ac1bb77}
Type Version	5.0.0.0
API Version	6.1.0.0
Vendor	AutoDesSys, Inc.
Vendor URL	www.formz.com
Status	Loaded

The Plugin Details dialog.

Clicking in any column except the first column in the list invokes the **Plugin Details** or **Script Details** dialog. These dialogs contain detailed information about the plugin or script as follows:

The **Plugin Details** dialog (see above) displays the following information:

Name: The name of the plugin (not the plugin file).

ID: A numeric ID assigned by the plugin developer.

Version: The version of the plugin (assigned by the plugin developer).

File Name: The name of the plugin file (.fzp) containing the plugin.

Path: The full path to the folder containing the plugin file.

Type: The type of the plugin as described above.

Type ID: A numeric ID which identifies the plugin type.

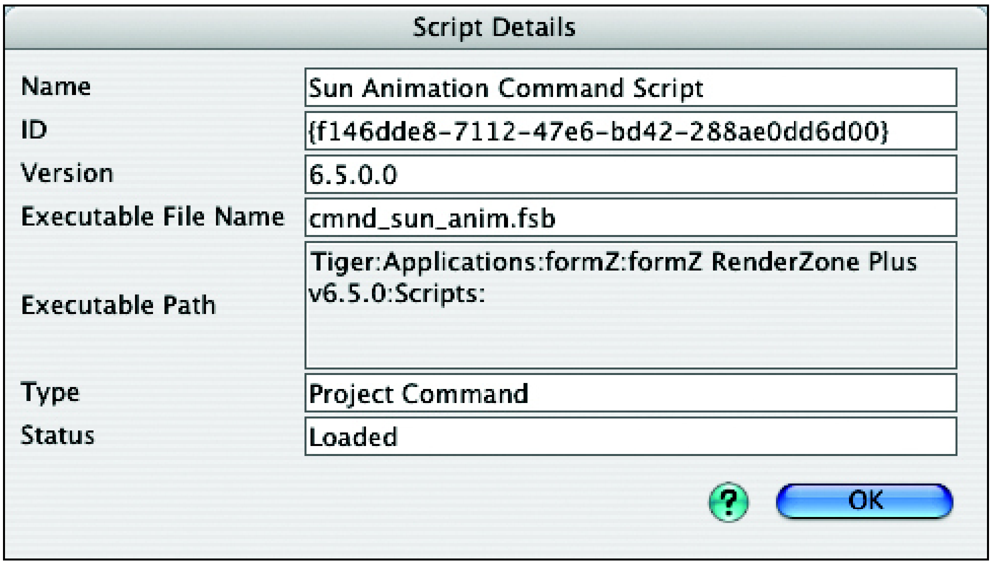
Type Version: The version of the plugin type.

API Version: The version of the plugin API used to create the plugin.

Vendor: The name of the vendor who developed or distributed the plugin.

Vendor URL: The URL to the plugin vendor’s web site. Status: Whether or not the plugin is loaded.

Description: If the plugin developer wished to provide additional information, it will be contained in this field. If no description is provided by the plugin developer, this field will not be displayed.



Name: Sun Animation Command Script
ID: {f146dde8-7112-47e6-bd42-288ae0dd6d00}
Version: 6.5.0.0
Executable File Name: cmnd_sun_anim.fsb
Executable Path: Tiger:Applications:formZ:formZ RenderZone Plus v6.5.0:Scripts:
Type: Project Command
Status: Loaded

The Script Details dialog.

The **Script Details** dialog (see above) displays the following information:

Name: The name of the script (not the script file).

ID: A numeric ID assigned by the script developer.

Version: The version of the script (assigned by the script developer).

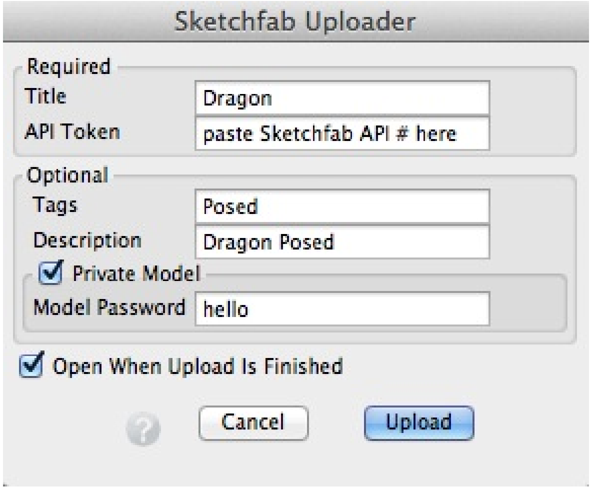
Executable File Name: The name of the executable script file (.fsb) containing the script. Executable Path: The full path to the folder containing the executable script file.

Type: The type of the script as described above.

Status: Whether or not the script is loaded.

Clicking on the column title in the plugins and scripts list (at the top of a column) sorts the list alphabetically using this column. Pressing the option key on the Macintosh or ctrl+shift on Windows when clicking in the column title will sort the list in descending order rather than the default ascending order.

Sketchfab Uploader...



Required
Title: Dragon
API Token: paste Sketchfab API # here
Optional
Tags: Posed
Description: Dragon Posed
☑ Private Model
Model Password: hello
☑ Open When Upload Is Finished

The Sketchfab Uploader Options.

Sketchfab.com is a website that allows you to upload your 3D models so others can view and navigate around the model in real time. You can publish your models through **Sketchfab.com**, or you can embed them into your own web pages.

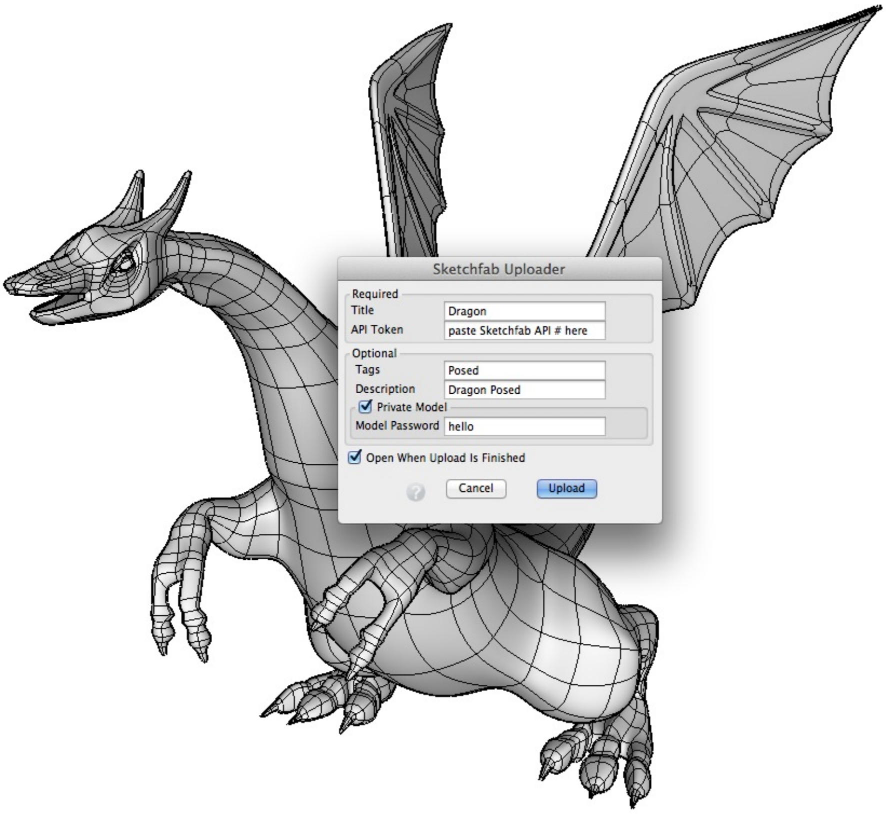
See **www.sketchfab.com** for more details and to create your free account.

When you select the **Sketchfab Uploader** menu item, a dialog is invoked for information about the model. The name of the model and an API token are required. The API token is unique to your **Sketchfab** account, and can be found in the **My Settings** section of the **Sketchfab** site.

The Optional section includes tags that can be used to find your model on the site and the description of the model that appears with the model. If you only want specific users to access the model, you can set a protective password for the model.

Open When Upload is Finished: This option will launch your web browser to the page the the model is displayed on after the upload and processing are complete. You can continue to work on modeling projects while the upload takes place.

Be sure to check out the **Sketchfab FAQ** for the basics and any troubleshooting. **form•Z** automatically takes care of the export format and the upload to the **Sketchfab** site. It will provide the url where your model can be viewed, as well.

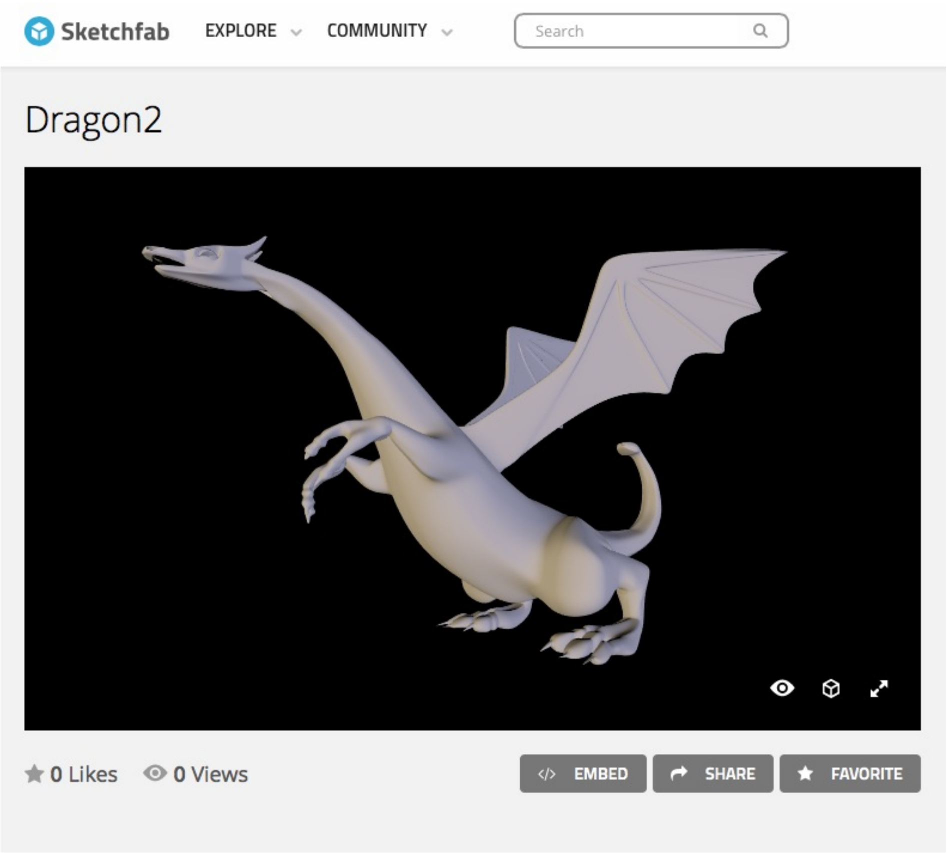


Required
Title: Dragon
API Token: paste Sketchfab API # here

Optional
Tags: Posed
Description: Dragon Posed
☑ Private Model
Model Password: hello

☑ Open When Upload Is Finished

A form•Z Subdivision model prior to being uploaded to Sketchfab.



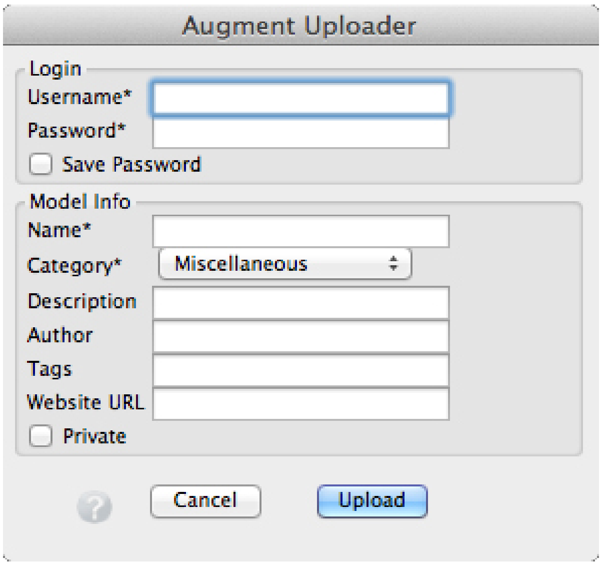
The resulting model on the Sketchfab site.

Augment Uploader...

Augment is an augmented reality application that allows a user to view 3D models in a real time, real scale environment via smartphone or tablet. 3D models are uploaded to Augment’s servers and these models can be managed or accessed from their website or from a downloadable application.

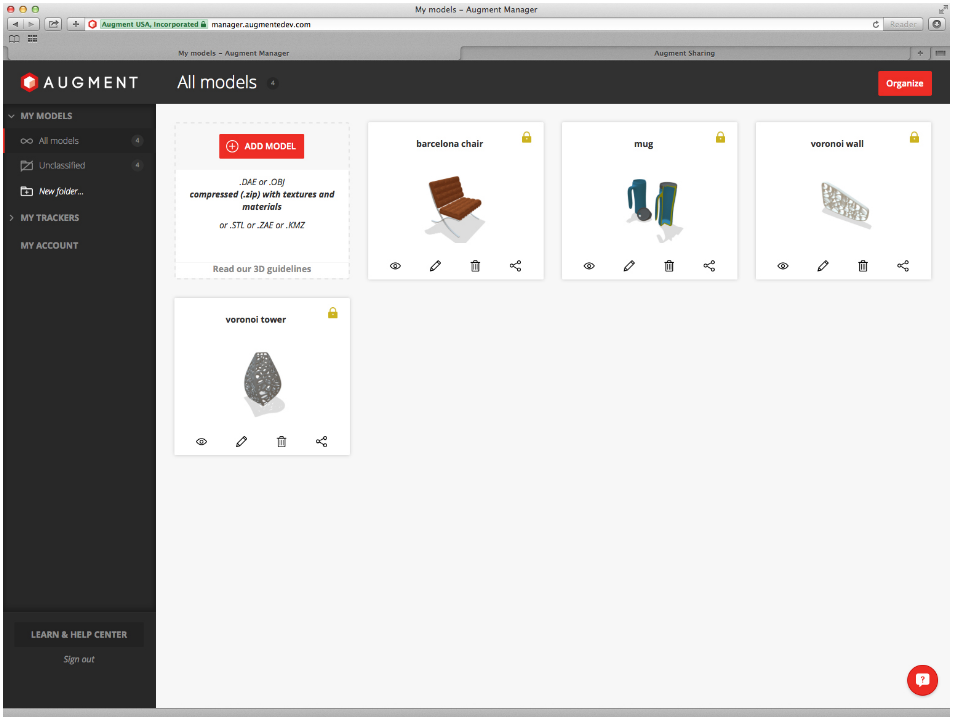
For more information, visit **http://augmentedev.com** and create an account to get started.

The form•Z **Augment Uploader** exports the 3D model in the active project window to Augment's servers with the correct file type, orientation, and options. This eliminates a number of steps to properly export and zip the project files and manually adding models the **Augment Manager.**

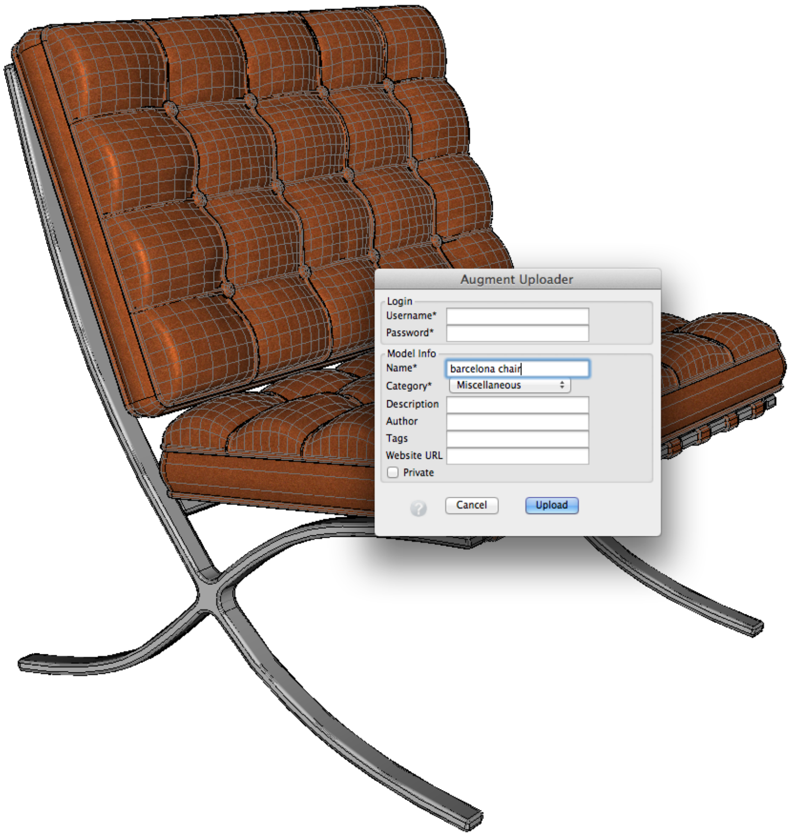

Category* Miscellaneous

Augment Uploader Dialogue and Options

When you select **Augment Uploader** from the **Extensions** menu item, a dialog appears which requires the user's information before the model is successfully exported. The **Login Username** and **Password** is the username and password that is used to log into the **Augment** website and/or application. If the **Save Password** option is checked, then form•Z will remember the password entered into the field for any succeeding project that is uploaded. The **Name** is the name of the model being uploaded. This does not have to be an exact filename, it is just the name that appears in the **Augment Manager**. The **Category** is a drop-down list of different categories that can be selected to help organize the files in the **Augment Manager**. The bottom four fields for **Description**, **Author**, **Tags**, and **Website URL** are all optional and do not need to be filled in to upload your model. The selection box for Private indicates if the model will only be available for the uploader to view (checked) or if the model can be made available for public browsing and searching (unchecked).


.DAE or .OBJ compressed (.zip) with textures and materials or .STL or .ZAE or .KMZ

Augment Manager Screenshot

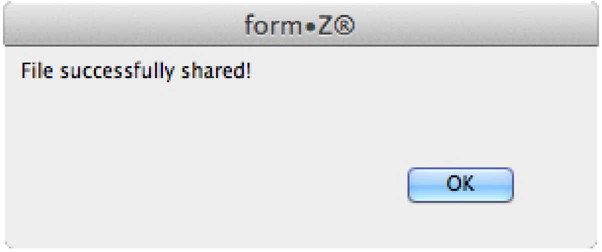


Name* barcelona chair

Category* Miscellaneous

Model Screenshot with Augment Dialogue

Once the required information is filled out and **Upload** is clicked, a progress bar will appear in the **Action Palette**. When the model has been successfully uploaded, a confirmation dialogue will appear and your default internet browser will open a new web page from Augment's website with a scannable **QR code**. If you have the application already installed on your smartphone or tablet, you can select the scan button in the application and scan the **QR code** to view the uploaded model in augmented reality.



File successfully shared!

Augment Upload confirmation dialogue

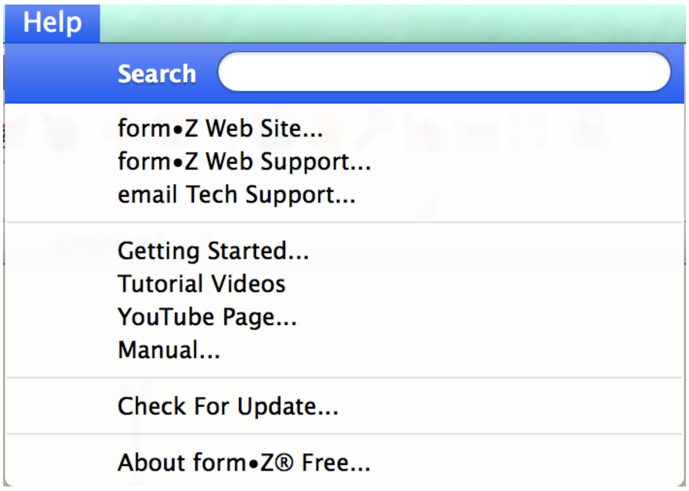
Help Menu

This menu consists of five groups.

The first group contains commands that take you directly to the **form•Z** web page, and to the **form•Z** forum, or they set you up for sending an e-mail to the AutoDesSys technical support group.

The second group contains commands that invoke the **Getting Started...** dialog and other resources like tutorial videos and the manuals.

The third and fourth groups of the **Help** menu contain commands for updating and registering your license.



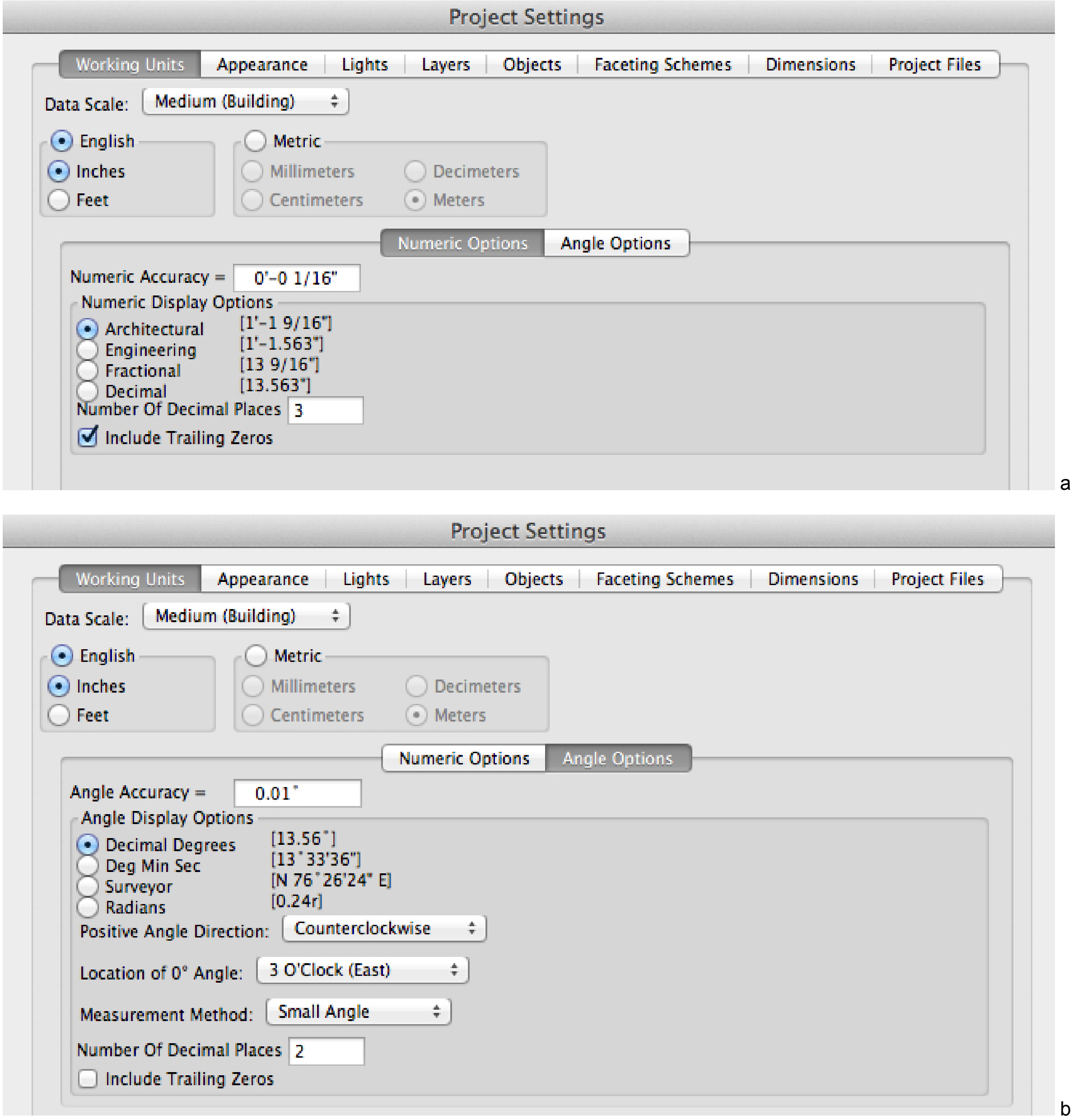
The Help Menu

The fifth and final group contains the single command **About form•Z Free**. When selected the introductory splash screen of the program is displayed. Click once on the splash screen to dismiss it.

Project Settings

The **Project Settings...** command in the **File** menu invokes the **Project Settings** dialog through which a number of settings can be chosen and/or changed. This dialog contains eight tabs, as follows:

Working Units: This tab offers options to set up the scale of your defaults through the **Data Scale** pop up menu, to select type of units of measurement (**English** or **Metric**), the accuracy, and the format in which numbers and angles are displayed.



Project Settings

Data Scale: Medium (Building)

● English ○ Metric

● Inches ○ Millimeters ○ Decimeters

○ Feet ○ Centimeters ● Meters

Numeric Accuracy = 0'-0 1/16"

Numeric Display Options

● Architectural [1'-1 9/16"]

○ Engineering [1'-1.563"]

○ Fractional [13 9/16"]

○ Decimal [13.563"]

Number Of Decimal Places 3

☑ Include Trailing Zeros

a

Project Settings

Data Scale: Medium (Building)

● English ○ Metric

● Inches ○ Millimeters ○ Decimeters

○ Feet ○ Centimeters ● Meters

Angle Accuracy = 0.01°

Angle Display Options

● Decimal Degrees [13.56°]

○ Deg Min Sec [13°33'36"]

○ Surveyor [N 76°26'24" E]

○ Radians [0.24r]

Positive Angle Direction: Counterclockwise

Location of 0° Angle: 3 O'Clock (East)

Measurement Method: Small Angle

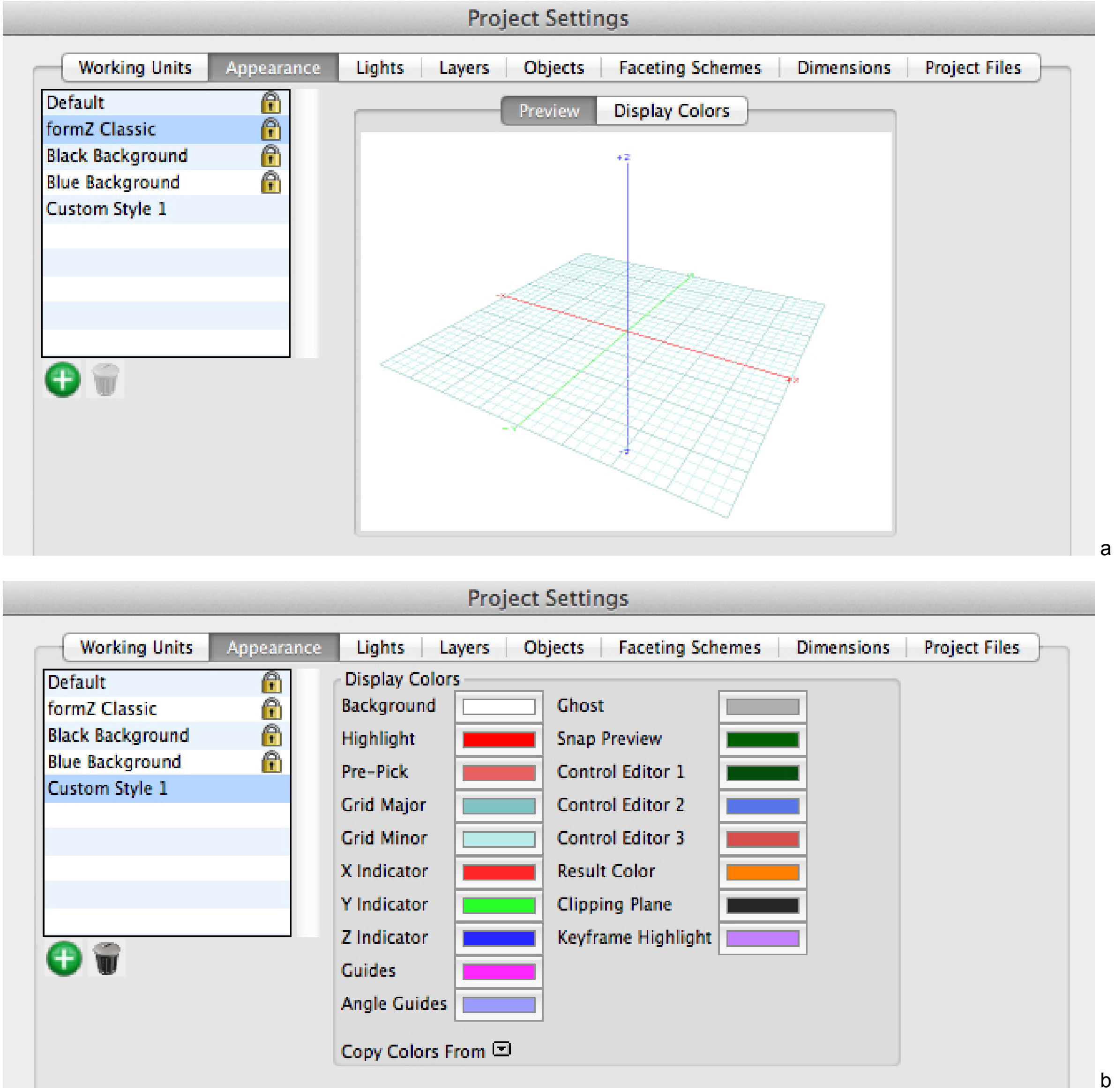
Number Of Decimal Places 2

☐ Include Trailing Zeros

b

Working Units Tab in Project Settings dialog:
(a) numeric options and (b) Angle Options..

Appearance: Through this tab you can select one of four preset settings or compose your own. When you select **Custom Style 1** or any new entry you may generate by clicking on **New**, the **Display Colors** list is invoked. You can set the default colors individually by clicking on any color box. This will invoke the standard **Colors** dialog of your operating system, where colors can be selected. You can also use the **Copy Colors From** pop up menu to start by copying the colors from a preset environment and then change whatever colors you wish. When you exit the **Project Settings** dialog, your project's appearance will be according to the active settings.



- Default
- formZ Classic
- Black Background
- Blue Background
- Custom Style 1

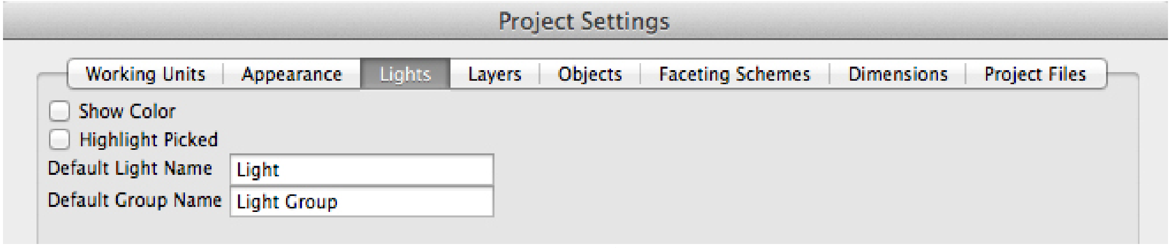
Display Colors

Background	⬜	Ghost	⬜
Highlight	🟥	Snap Preview	🟩
Pre-Pick	🟥	Control Editor 1	🟩
Grid Major	🟦	Control Editor 2	🟦
Grid Minor	🟦	Control Editor 3	🟥
X Indicator	🟥	Result Color	🟧
Y Indicator	🟩	Clipping Plane	⬛
Z Indicator	🟦	Keyframe Highlight	🟪
Guides	🟪		
Angle Guides	🟪		

Copy Colors From

The Appearance tab of the Project Settings dialog:
(a) for selecting preset environments and (b) for customizing your own.

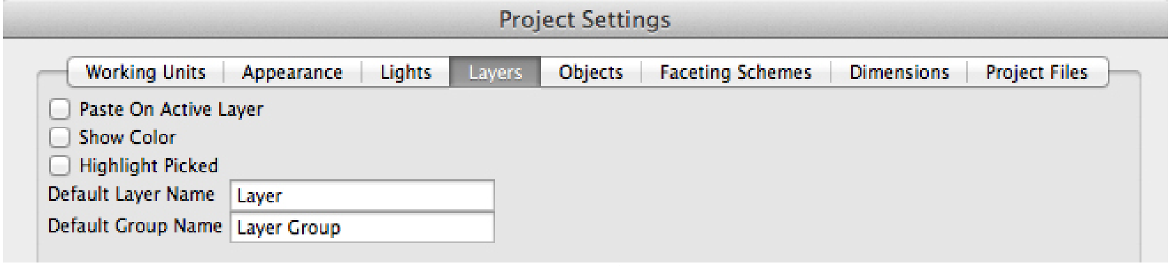
Lights: This tab offers options for whether or not the color of a light will be shown in the Lights palette and whether picked lights will be highlighted in the palette. It also allows you to define the default names used in the palette for new lights and groups.



☐ Show Color
☐ Highlight Picked
Default Light Name: Light
Default Group Name: Light Group

Lights tab in Project Settings dialog.

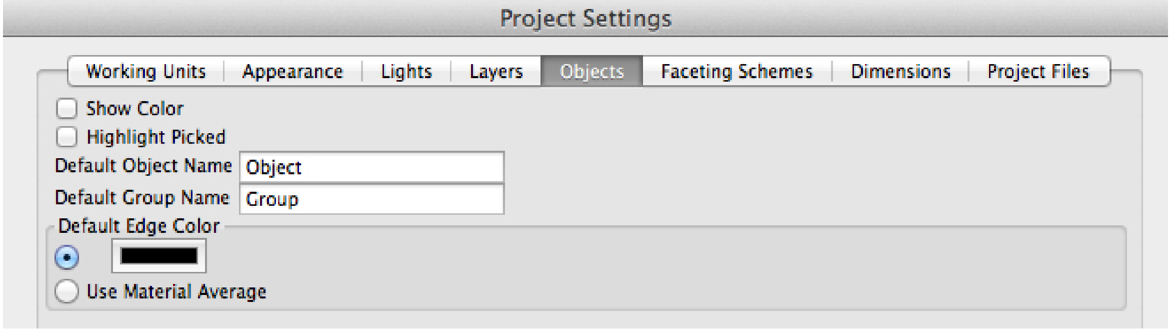
Layers: This tab contains options analogous to those of the **Lights** tab and three unique ones: **Draw In Order Shown, Draw Active Last**, and **Paste On Active Layer**.



☐ Paste On Active Layer
☐ Show Color
☐ Highlight Picked
Default Layer Name: Layer
Default Group Name: Layer Group

Layers tab in Project Settings dialog.

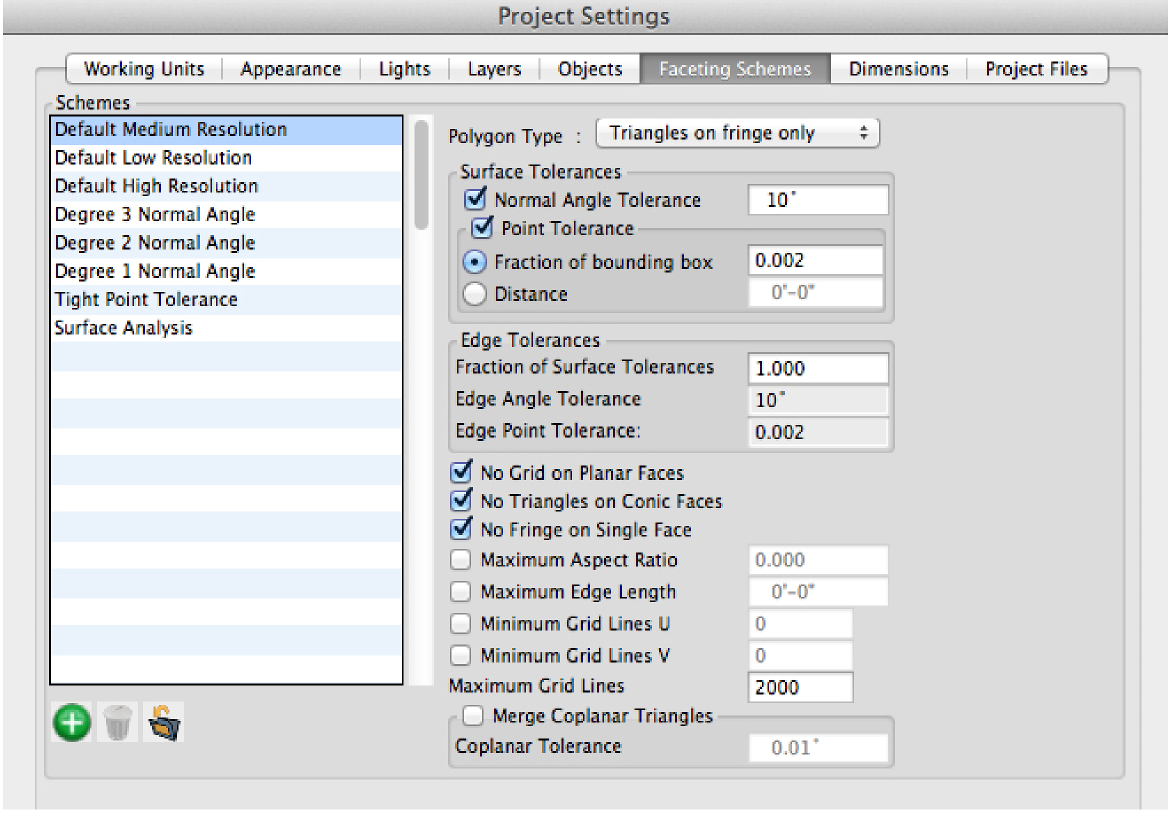
Objects: This tab contains, in addition to the options found in the **Lights** tab, the **Default Edge Color** pair of options that determine the color in which the edges of objects are shown. The default color can be changed using the color box. If the **Use Material Average** is selected, the edges will be shown as an average of the colors used in the material assigned to the object.



☐ Show Color
☐ Highlight Picked
Default Object Name: Object
Default Group Name: Group
Default Edge Color
● ■
○ Use Material Average

Objects tab in Project Settings dialog.

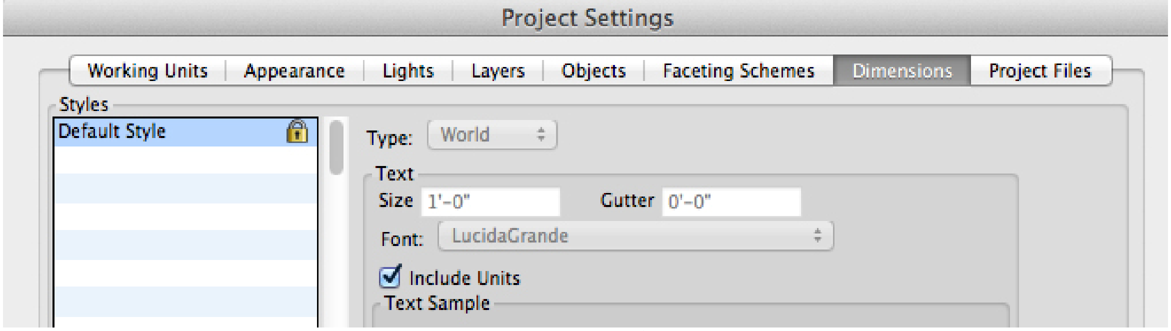
Faceting Schemes: This tab contains the options for faceting smooth objects and they are discussed in the respective section.



Polygon Type : Triangles on fringe only
Surface Tolerances
☑ Normal Angle Tolerance: 10˚
☑ Point Tolerance
● Fraction of bounding box: 0.002
○ Distance: 0'-0"
Edge Tolerances
Fraction of Surface Tolerances: 1.000
Edge Angle Tolerance: 10˚
Edge Point Tolerance: 0.002
☑ No Grid on Planar Faces
☑ No Triangles on Conic Faces
☑ No Fringe on Single Face
☐ Maximum Aspect Ratio: 0.000
☐ Maximum Edge Length: 0'-0"
☐ Minimum Grid Lines U: 0
☐ Minimum Grid Lines V: 0
Maximum Grid Lines: 2000
☐ Merge Coplanar Triangles
Coplanar Tolerance: 0.01˚

Faceting Schemes tab in Project Settings dialog.

Dimensions: This tab contains the options for setting dimension styles to be used when constructing dimension objects. The content of this tab is identical with that of the **Dimensions** dialog and is discussed in the respective section.

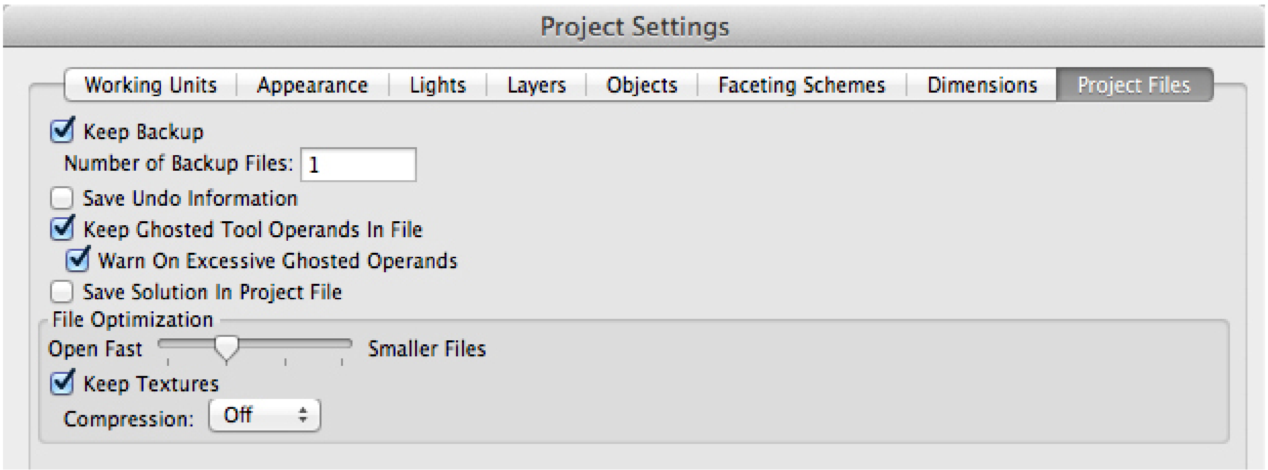


Type: World
Text
Size: 1'-0" Gutter: 0'-0"
Font: LucidaGrande
☑ Include Units
Text Sample

Dimensions tab in Project Settings dialog.

Project Files: This tab contains the options for **Keep Backup**, **Number of Backup Files, Save Undo Information**, **Keep Ghosted Tool Operands in File, Warn on Excessive Ghosted Operands**, and

Save Solution in Project file. They are the same options that can also be set up in the **Preferences** dialog and they are discussed in the **Preferences: Project: Files** section.



☑ Keep Backup
Number of Backup Files: 1
☐ Save Undo Information
☑ Keep Ghosted Tool Operands In File
☑ Warn On Excessive Ghosted Operands
☐ Save Solution In Project File
File Optimization
Open Fast Smaller Files
☑ Keep Textures
Compression: Off

Project Files tab in Project Settings dialog.

File Optimization: This slider determines the balance between file size and speed of opening the file. When the slider is a far left, the file will be large, but will open quickly. When the slider is at the far right, the file size will be the smallest, but it will be slow to open as most of it will be re-created at time of opening. This can help to make a file small enough to e-mail to a client or a colleague when neccessary. Files creating using the autosave option are always created with the smaller file setting to be efficient in size and execution time.

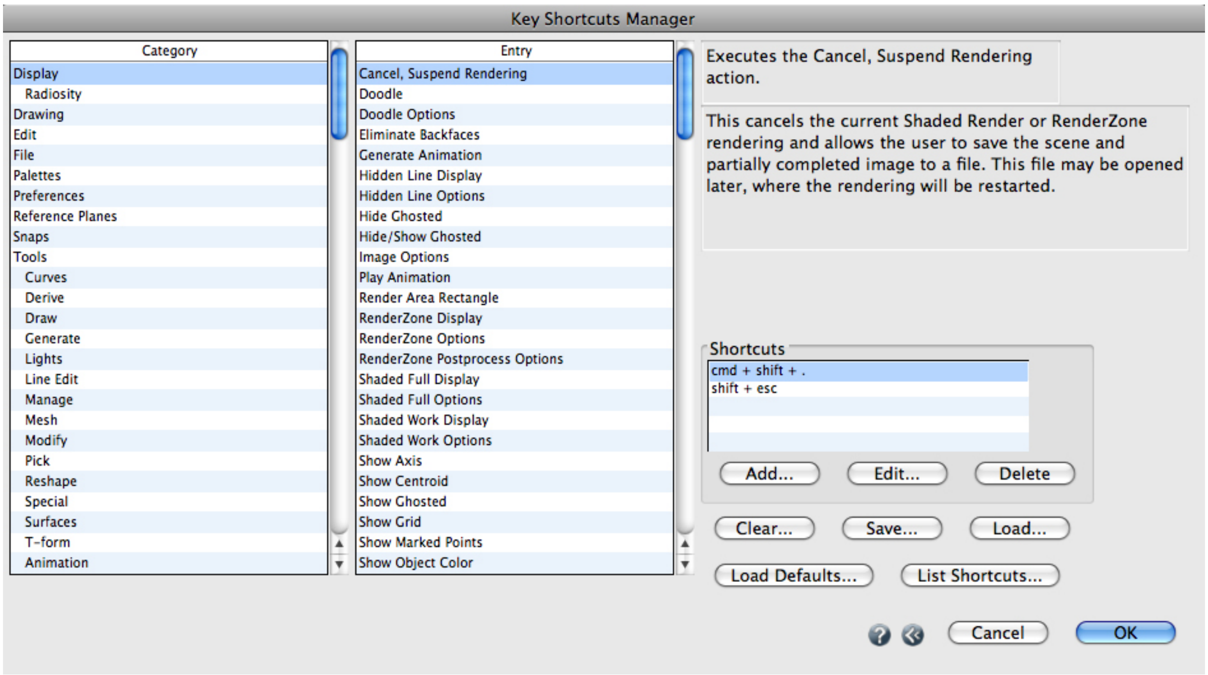
Keep Textures: When selected, the texture maps used in the project are saved in the file. This makes the files more portable as the textures are embedded in the file. When the option is off, the files will be smaller but the textures need to be re-loaded from their original location when the file is reopened.

The **Compression** menu offers options to help mitigate the size of the textures embedded in the project. The **Basic** option uses deflate (zip) which is a lossless compression method. The **JPEG** option generates much smaller files, but at the expense of image quality (i.e. "lossy"). Note that RenderZone will always load the original texture if the file is present in its original location for best results.

Key Shortcuts

The **Key Shortcuts...** command in the **Edit** menu invokes the **Key Shortcuts Manager** dialog shown. This dialog contains two lists, three non-editable information fields, and a few buttons.

The list on the left, labeled **Category**, lists the categories of **form•Z** actions. The specific content of each category is listed in the second list, labeled **Entry**. The content of the latter changes when the selection in the **Category** column changes.



Executes the Cancel, Suspend Rendering action.

This cancels the current Shaded Render or RenderZone rendering and allows the user to save the scene and partially completed image to a file. This file may be opened later, where the rendering will be restarted.

Shortcuts:
cmd + shift + .
shift + esc

The Key Shortcuts Manager dialog.

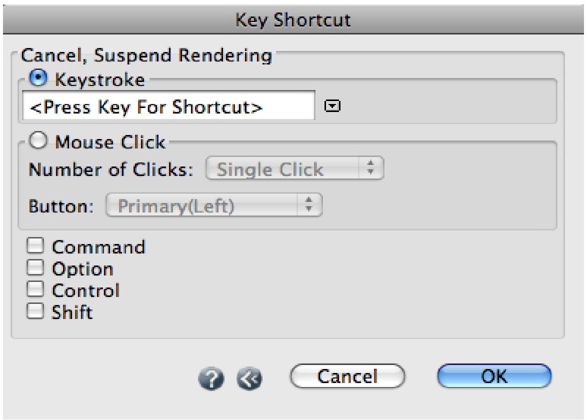
What each action does is summarized in the fields in the upper-right of the dialog and an indication of the type of action (menu item, tool, etc.) is also included. If a key shortcut is assigned to the action, that shortcut is displayed in the **Shortcuts** field.

New shortcuts can be defined through the **Key Shortcut** dialog, invoked from the **Add...** button. Existing shortcuts can be changed again through the **Key Shortcut** dialog, invoked from the **Edit...** button. Or they can be completely eliminated using the **Delete** button.

Clear... clears all the currently loaded shortcuts, **Save...** saves the current shortcuts into a file, and **Load...** loads shortcuts from a previously saved file.

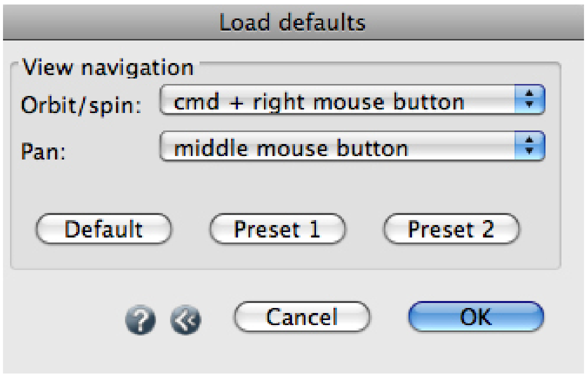
Load Defaults... invokes the **Load Defaults** dialog from where different sets of defaults can be selected, through three buttons: **Default** is the **form•Z** defaults; **Preset 1** is defaults according to Rhino and **Preset 2** is defaults according to SketchUp. When one of these buttons is selected, the items of the **Orbit/Spin** and **Pan** pull down menus also change to reflect the respective default. However, these actions can also be set independently.

Pressing List Shortcuts... in the **Key Shortcuts Manager** dialog invokes the **Shortcuts** List dialog shown. It contains four columns labeled **Category**, **Key**, **Command**, and **Description** and it is essentially a list of all the key shortcuts and what commands they correspond to. It can be sorted in two different ways.



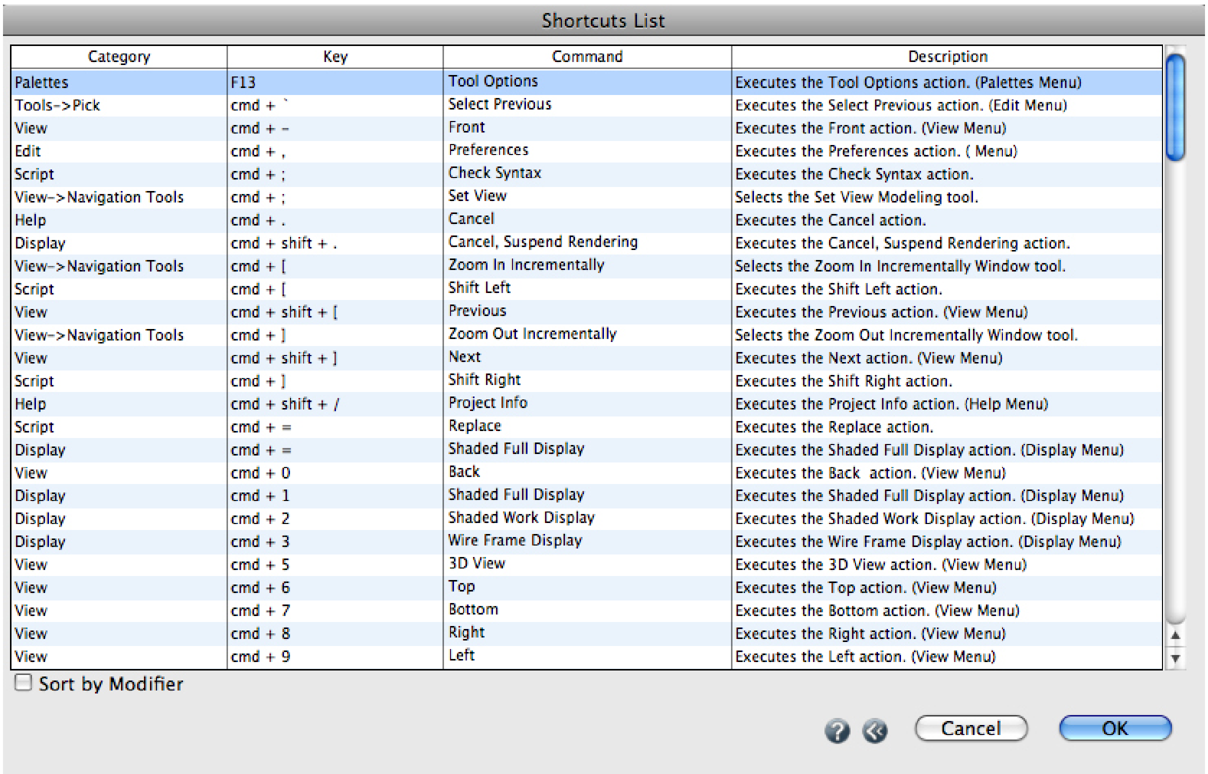
● Keystroke
<Press Key For Shortcut>
○ Mouse Click
Number of Clicks: Single Click
Button: Primary(Left)
☐ Command
☐ Option
☐ Control
☐ Shift

The Key Shortcut Dialog.



Orbit/spin: cmd + right mouse button
Pan: middle mouse button

The Load Defaults Dialog.



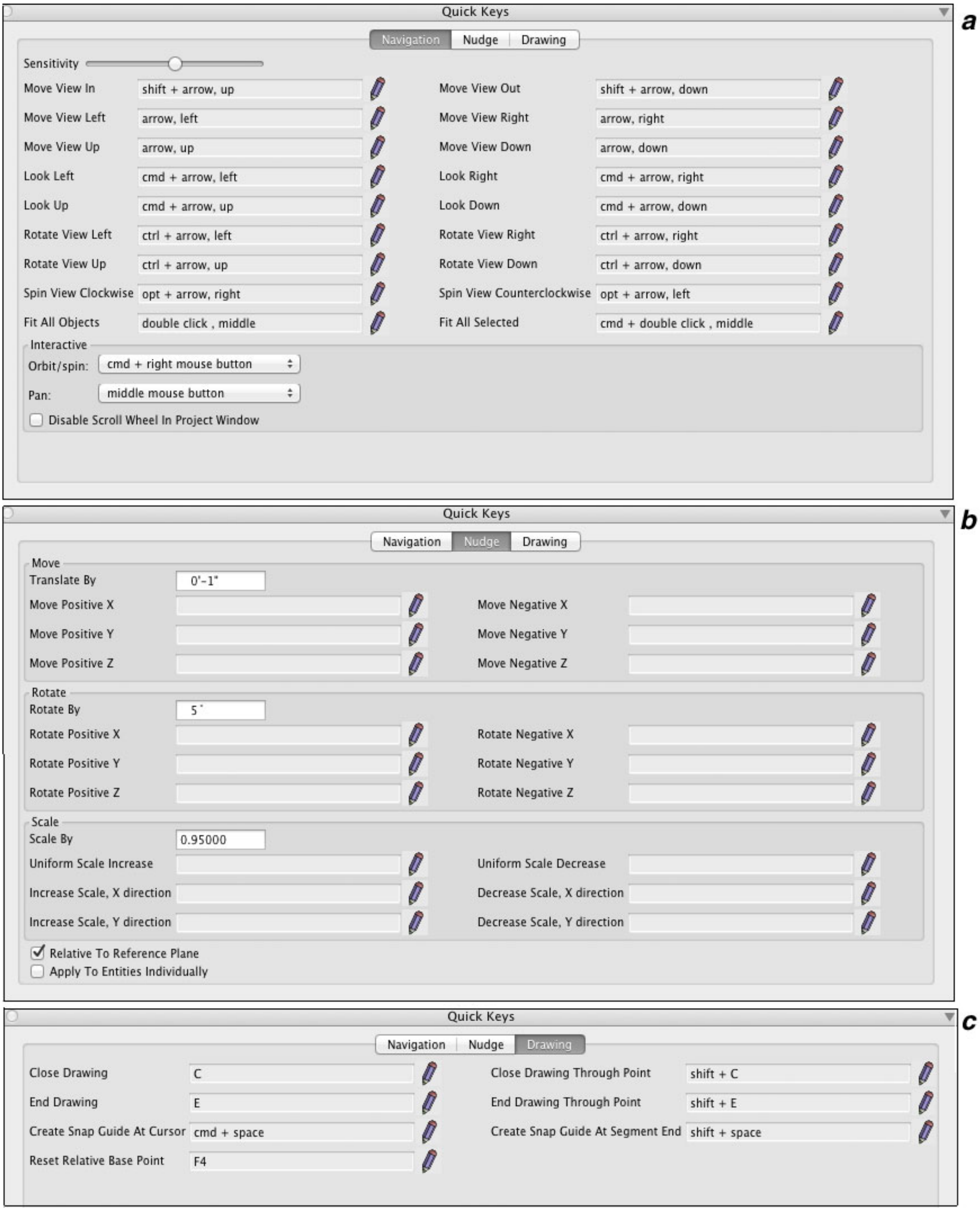
Category	Key	Command	Description
Palettes	F13	Tool Options	Executes the Tool Options action. (Palettes Menu)
Tools->Pick	cmd + `	Select Previous	Executes the Select Previous action. (Edit Menu)
View	cmd + -	Front	Executes the Front action. (View Menu)
Edit	cmd + ,	Preferences	Executes the Preferences action. (Menu)
Script	cmd + ;	Check Syntax	Executes the Check Syntax action.
View->Navigation Tools	cmd + ;	Set View	Selects the Set View Modeling tool.
Help	cmd + .	Cancel	Executes the Cancel action.
Display	cmd + shift + .	Cancel, Suspend Rendering	Executes the Cancel, Suspend Rendering action.
View->Navigation Tools	cmd + [	Zoom In Incrementally	Selects the Zoom In Incrementally Window tool.
Script	cmd + [	Shift Left	Executes the Shift Left action.
View	cmd + shift + [	Previous	Executes the Previous action. (View Menu)
View->Navigation Tools	cmd +]	Zoom Out Incrementally	Selects the Zoom Out Incrementally Window tool.
View	cmd + shift +]	Next	Executes the Next action. (View Menu)
Script	cmd +]	Shift Right	Executes the Shift Right action.
Help	cmd + shift + /	Project Info	Executes the Project Info action. (Help Menu)
Script	cmd + =	Replace	Executes the Replace action.
Display	cmd + =	Shaded Full Display	Executes the Shaded Full Display action. (Display Menu)
View	cmd + 0	Back	Executes the Back action. (View Menu)
Display	cmd + 1	Shaded Full Display	Executes the Shaded Full Display action. (Display Menu)
Display	cmd + 2	Shaded Work Display	Executes the Shaded Work Display action. (Display Menu)
Display	cmd + 3	Wire Frame Display	Executes the Wire Frame Display action. (Display Menu)
View	cmd + 5	3D View	Executes the 3D View action. (View Menu)
View	cmd + 6	Top	Executes the Top action. (View Menu)
View	cmd + 7	Bottom	Executes the Bottom action. (View Menu)
View	cmd + 8	Right	Executes the Right action. (View Menu)
View	cmd + 9	Left	Executes the Left action. (View Menu)

☐ Sort by Modifier

The Shortcuts List dialog.

Quick Keys

This palette is invoked from the **Palettes** menu and lists all the "hidden" shortcuts, under three tabs: **Navigation, Nudge,** and **Drawing**. The same key commands are also listed in the **Key Shortcuts Manager** dialog, but are listed here again separately to make them more accessible. They can all be edited, by clicking on the pencil icon next to them, and other keys may be assigned to them. As a matter of fact the **Nudge** commands have no default assignments and these will have to be made by the user.



Move View In	shift + arrow, up	Move View Out	shift + arrow, down
Move View Left	arrow, left	Move View Right	arrow, right
Move View Up	arrow, up	Move View Down	arrow, down
Look Left	cmd + arrow, left	Look Right	cmd + arrow, right
Look Up	cmd + arrow, up	Look Down	cmd + arrow, down
Rotate View Left	ctrl + arrow, left	Rotate View Right	ctrl + arrow, right
Rotate View Up	ctrl + arrow, up	Rotate View Down	ctrl + arrow, down
Spin View Clockwise	opt + arrow, right	Spin View Counterclockwise	opt + arrow, left
Fit All Objects	double click , middle	Fit All Selected	cmd + double click , middle

Interactive
Orbit/spin: cmd + right mouse button
Pan: middle mouse button
☐ Disable Scroll Wheel In Project Window

Move
Translate By: 0'-1"

Move Positive X		Move Negative X	
Move Positive Y		Move Negative Y	
Move Positive Z		Move Negative Z	

Rotate
Rotate By: 5˚

Rotate Positive X		Rotate Negative X	
Rotate Positive Y		Rotate Negative Y	
Rotate Positive Z		Rotate Negative Z	

Scale
Scale By: 0.95000

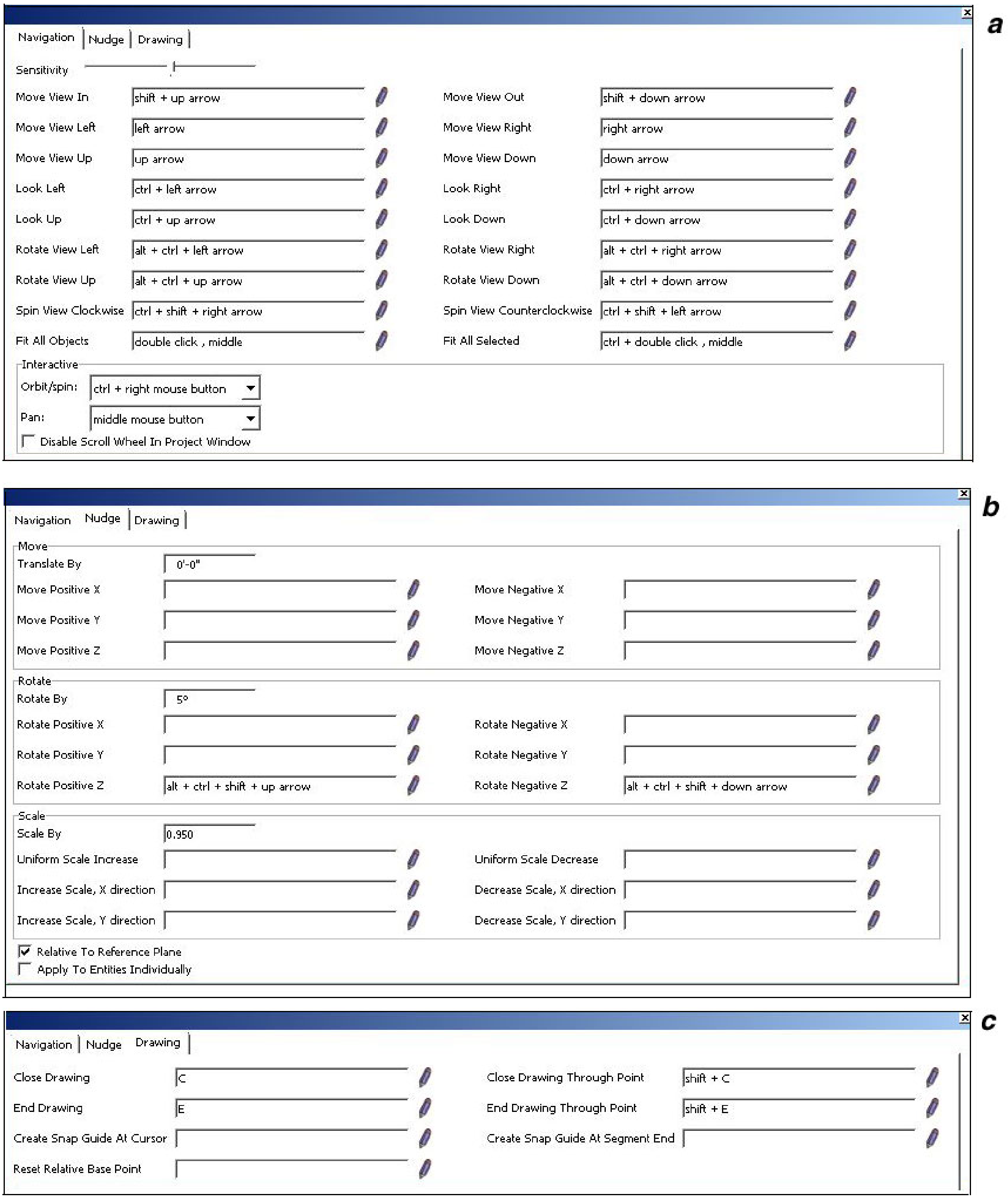
Uniform Scale Increase		Uniform Scale Decrease	
Increase Scale, X direction		Decrease Scale, X direction	
Increase Scale, Y direction		Decrease Scale, Y direction	

☑ Relative To Reference Plane
☐ Apply To Entities Individually

Close Drawing	C	Close Drawing Through Point	shift + C
End Drawing	E	End Drawing Through Point	shift + E
Create Snap Guide At Cursor	cmd + space	Create Snap Guide At Segment End	shift + space
Reset Relative Base Point	F4		

The Quick Keys palette tabs: (a) Navigation, (b) Nudge, and (c) Drawing (Macintosh versions).

In addition to the list of commands, there are a few options that require mention. At the top of the **Navigation** tab, the **Sensitivity** sliding bar controls the magnitude of the motion of the transformation commands. When **Disable Scroll Wheel In Project Window** is checked, the mouse scroll wheel will have no effect. The **Nudge** tab contains numeric parameters that control the nudge distances.



Sensitivity

Move View In: shift + up arrow
Move View Out: shift + down arrow
Move View Left: left arrow
Move View Right: right arrow
Move View Up: up arrow
Move View Down: down arrow
Look Left: ctrl + left arrow
Look Right: ctrl + right arrow
Look Up: ctrl + up arrow
Look Down: ctrl + down arrow
Rotate View Left: alt + ctrl + left arrow
Rotate View Right: alt + ctrl + right arrow
Rotate View Up: alt + ctrl + up arrow
Rotate View Down: alt + ctrl + down arrow
Spin View Clockwise: ctrl + shift + right arrow
Spin View Counterclockwise: ctrl + shift + left arrow
Fit All Objects: double click , middle
Fit All Selected: ctrl + double click , middle

Orbit/spin: ctrl + right mouse button
Pan: middle mouse button
☐ Disable Scroll Wheel In Project Window

Translate By: 0'-0"
Move Positive X
Move Negative X
Move Positive Y
Move Negative Y
Move Positive Z
Move Negative Z

Rotate By: 5°
Rotate Positive X
Rotate Negative X
Rotate Positive Y
Rotate Negative Y
Rotate Positive Z: alt + ctrl + shift + up arrow
Rotate Negative Z: alt + ctrl + shift + down arrow

Scale By: 0.950
Uniform Scale Increase
Uniform Scale Decrease
Increase Scale, X direction
Decrease Scale, X direction
Increase Scale, Y direction
Decrease Scale, Y direction

☑ Relative To Reference Plane
☐ Apply To Entities Individually

Close Drawing: C
Close Drawing Through Point: shift + C
End Drawing: E
End Drawing Through Point: shift + E
Create Snap Guide At Cursor
Create Snap Guide At Segment End
Reset Relative Base Point

The Quick Keys palette tabs: (a) Navigation, (b) Nudge, and (c) Drawing (Windows versions).

Preferences: System

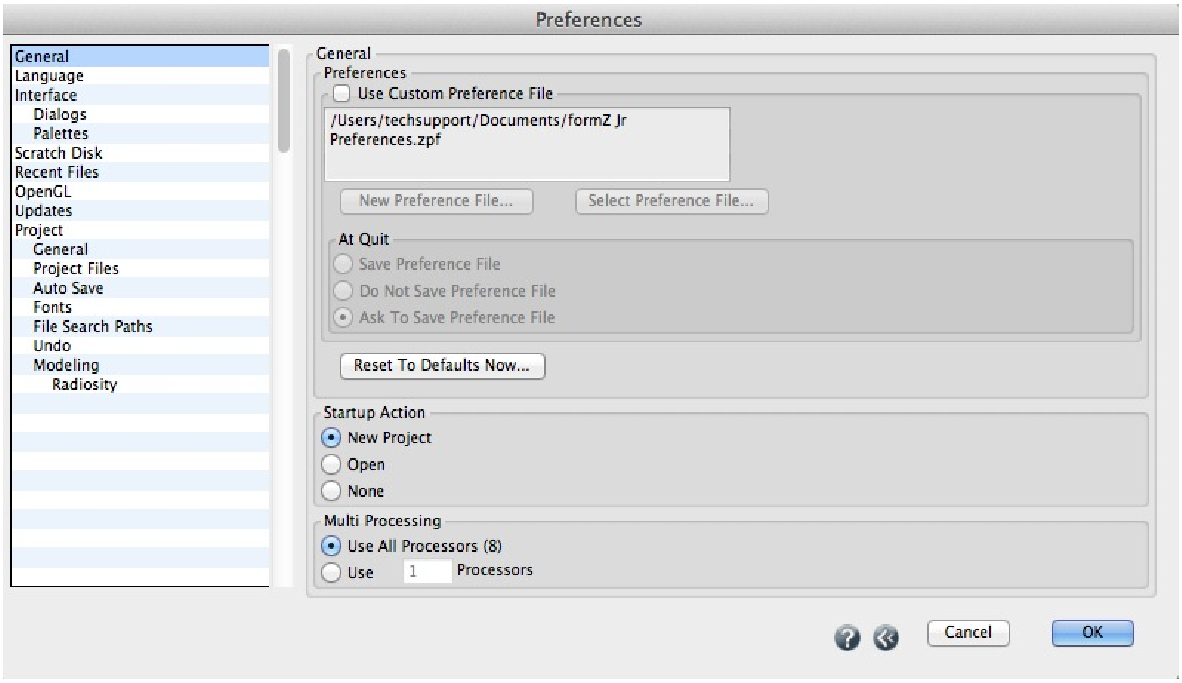
When **Preferences...** is selected from the **Edit** menu the **Preferences** dialog is invoked. This dialog is structured hierarchically and displays a list of categories on its left side. Clicking on an item displays the options that affect that item.

System: General

This category specifies which preference file to use and what action to perform at start-up.

Preferences File: This group determines what preference settings will be applied when **form•Z** is launched. When the selected option is changed, you have the opportunity to change preferences immediately or at the next launch.

> **Use Custom Preference File**: The parameters stored in the file whose name appears in the field of this option will be applied.
>
> **At Quit**: when quitting **form•Z**, changes you have made to preferences since launching the application will either be saved, not saved (preferences remain unchanged), or a prompt will appear asking if changes to the preferences should or should not be kept. The commands are: **Save Preference File**, **Do Not Save Preference File**, and **Ask to Save Preference File**.
>
> **Reset to Defaults Now...**: this button restores the **Preferences** to the original default state that appears the very first time you launch **form•Z.**
>
> **Startup Action**: Determines what command is performed when **form•Z** is launched. The options are: **New Project** (creates a new project), **Open** (opens an existing file that the user chooses) and **None** (does nothing).



☐ Use Custom Preference File

/Users/techsupport/Documents/formZ Jr Preferences.zpf

○ Save Preference File
○ Do Not Save Preference File
● Ask To Save Preference File

● New Project
○ Open
○ None

● Use All Processors (8)
○ Use 1 Processors

The Preferences dialog with the System: General options displayed.

System: Language

This category offers the ability to switch between different languages. Note that the language defaults are determined by the operating system settings. On OS X they are found in the International System Preferences. On Windows they are in the Regional and Language Options control panel.

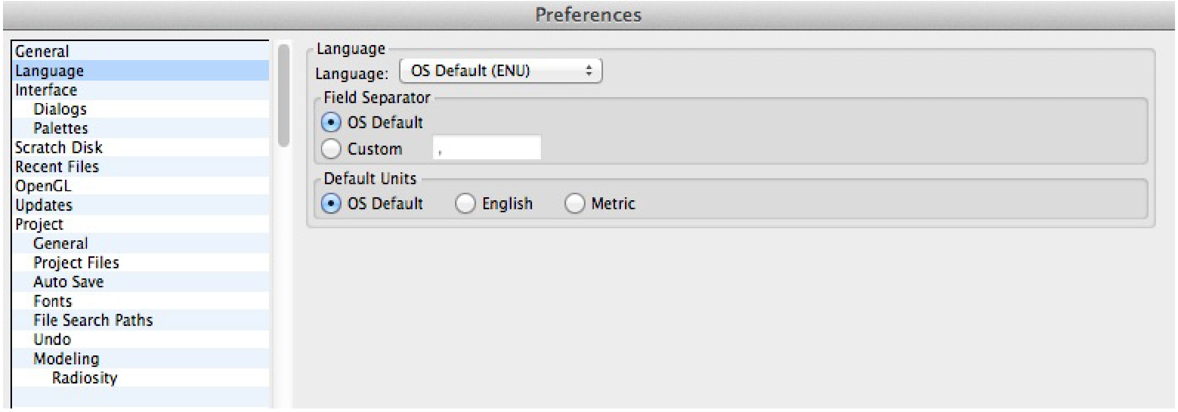
> **Language**: This menu determines what language is used through out the **form•Z** interface. It contains a list of all languages installed. The default language is determined from the operating system's language. If the default system language was not installed by the **form•Z** Installer, English is used as the default language. Note that changes to this setting take effect the next time **form•Z** is launched.

Field Separator: This character is used to delimit lists of numbers.

OS Default: With this option the default is determined by the settings on your computer. The default is the comma (,) for localization settings where a period (.) is used as the decimal separator. The default is a semi colon (;) for settings where a comma (,) is used as the decimal separator.

Custom: With this option the character entered in its text field is used as the field separator.

Default Units: This group determines the default work units. There are three options: **OS Default** (default is determined by the operating system), **English** and **Metric**.



Language

Language: OS Default (ENU)

Field Separator

● OS Default

○ Custom ,

Default Units

● OS Default ○ English ○ Metric

The Preferences dialog with the System: Language options displayed.

System: Interface

The **Interface** options are organized into two tabs: **Dialogs** and **Palettes**. There are some options that appear directly in the **Interface** tab, rather than the sub-tabs.

Show Tips: when checked this option will display pop-up tool tips when the cursor is moved over a tool icon. **Delay Seconds** is the length of time that the cursor needs to be left over the tool icon before the tool tip pop-up appears.

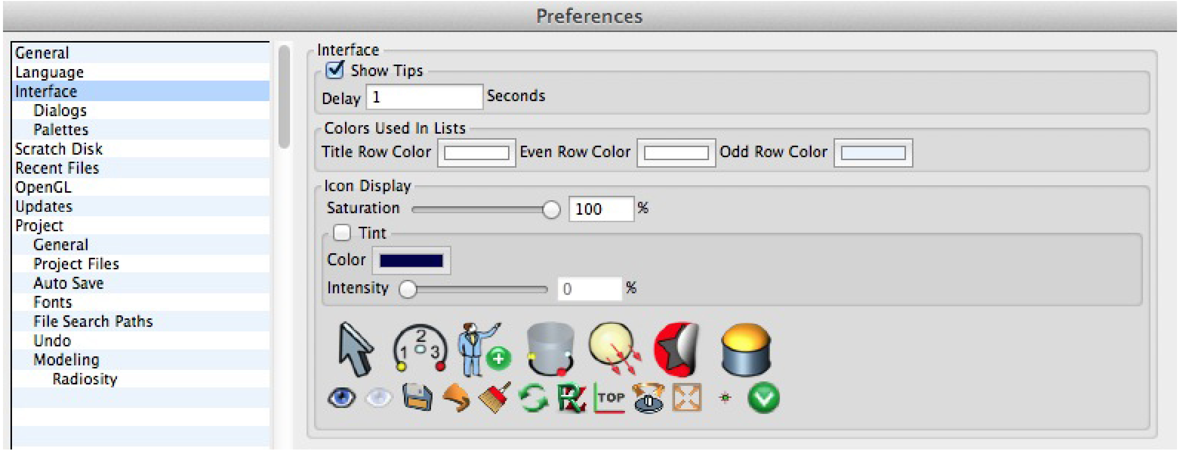
Colors Used in Lists: These options specify the colors used for the background of lists in palettes and dialogs. These colors are intended to make lists easier to read. They are: **Title Row Color**, **Even Row Color**, and **Odd Row Color**. Each is associated with a color box whose color can be changed.

Icon Display: there are two slider controls here for changing the appearance of the icons throughout the interface.

Saturation: moving this slider will alter the how vivid the colors of the icons are. Moving it as far left as possible will make the icons appear in grayscale mode only. Moving it between far left and far right will create a mix of the full color icons and gray icons, muting the colors by the amount selected.

Tint: This color box and slider can be used to assign a custom color that will be mixed with the icons, the **Intensity** slider controls the strength of this mixture.

The sample icons directly below the the display sliders preview the changes made to the sliders. The **form•Z** application must be restarted before changes to the icons will appear.



Interface

☑ Show Tips

Delay 1 Seconds

Colors Used In Lists

Title Row Color Even Row Color Odd Row Color

Icon Display

Saturation 100 %

☐ Tint

Color

Intensity 0 %

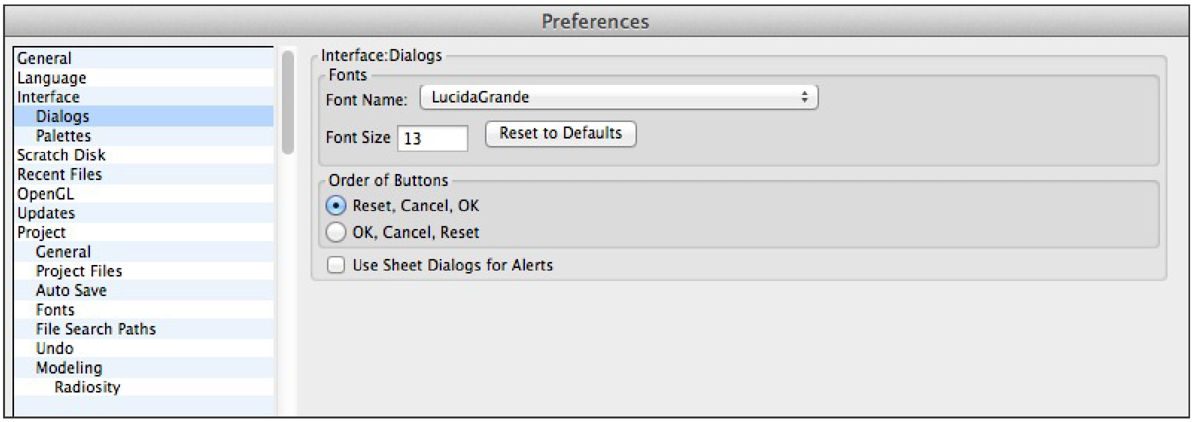
Preferences: System: Interface Options: Interface tab.

Interface: Dialogs

Fonts: Font Name controls which font and **Font Size** the text size used in the dialogs. The **Reset To Defaults** button resets the font and size to the system defaults. Note that the changes in the font settings are not visible until the next dialog is opened. The default font settings vary depending on the language and operating system.

Order Of Buttons: These options determine the order of the standard **OK**, **Cancel**, and **Reset** buttons at the bottom of the dialog. **Reset**, **Cancel**, **OK** is the default for OS X and **OK**, **Cancel**, **Reset** is the default for Windows.

Use Sheet Dialogs For Alerts: Applying to OS X only, when on, alert messages are displayed in sheets that slide out from the top of the active window rather than in an independent alert window.



Interface:Dialogs

Fonts

Font Name: LucidaGrande

Font Size 13

Order of Buttons

● Reset, Cancel, OK

○ OK, Cancel, Reset

☐ Use Sheet Dialogs for Alerts

Preferences: System: Interface options: Dialogs tab.

Interface: Palettes

Fonts, Font Name, Font Size, Reset To Defaults: As for the **Dialogs** tab.

List Palettes: If checked, the tool names are shown below each icon on the main tool palette. Uncheck this to turn off display of the tool names. This will make the tool palette smaller. Note that this option is only available on displays with a height greater than 800 pixels. On displays less than 800 pixels high, this option is always off (no tool names).

Clicking in an Empty Space Creates a New Entry: this item when checked allows the creation of new items in palettes by simply clicking in a blank area of the list. This method of creating new items will be in addition to the green **Add** (⊕) icon at the top of each list palette.

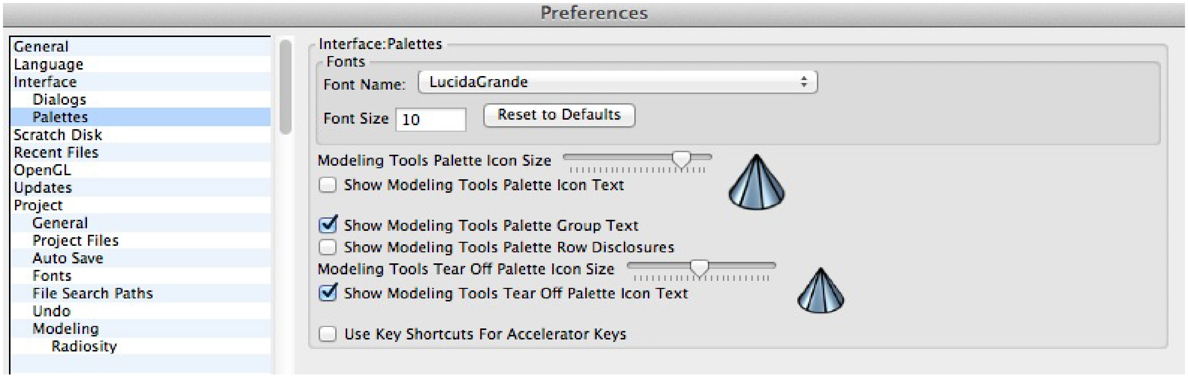
form•Z classic layout: this alters the appearance of the list palettes to be as those of the previous versions of **form•Z**. In this layout, the icon columns will be displayed at the left side of each palette, instead of on the right.

Keep Lists Tightly Spaced: this setting reduces the space between lists.

Show Vertical Separators: this setting draws thin vertical lines between the columns.

Animate Palette Transitions: this setting causes the collapsing and expanding of palettes to appear to either gradually expand and contract, or do so instantly with no gradual transition.

Pop-Up Tool Palettes On Hover: this setting causes the pop-out tool rows to pop-up automatically when the cursor is left over a tool icon that starts a pop-out tool row. If this setting is not checked, the mouse must be clicked and then released on the first tool icon before the tool row will pop up. This is closer to the way this worked in previous versions of **form•Z**.



Font Name: LucidaGrande

Font Size 10

Modeling Tools Palette Icon Size

☐ Show Modeling Tools Palette Icon Text

☑ Show Modeling Tools Palette Group Text

☐ Show Modeling Tools Palette Row Disclosures

Modeling Tools Tear Off Palette Icon Size

☑ Show Modeling Tools Tear Off Palette Icon Text

☐ Use Key Shortcuts For Accelerator Keys

Preferences: System: Interface options: Palettes tab.

Scratch Disk

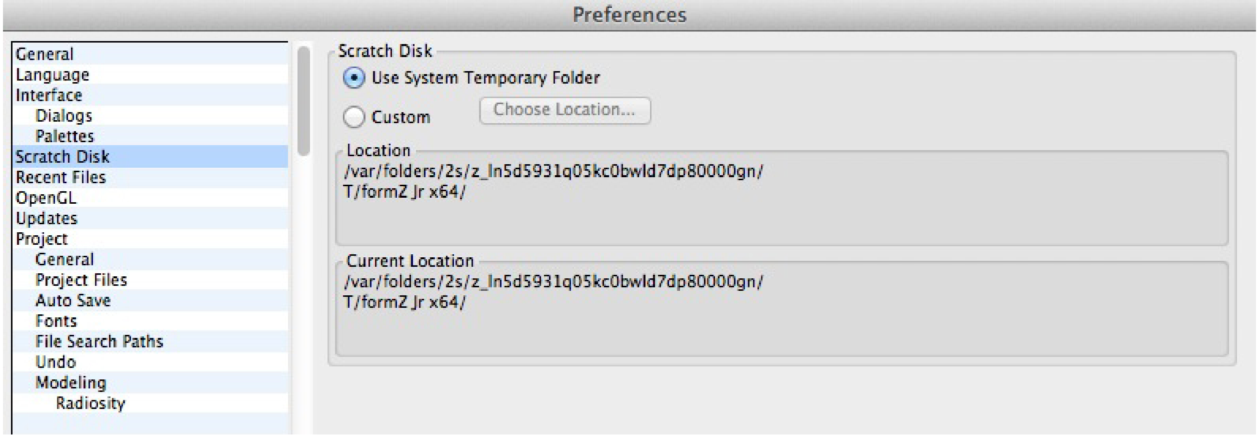
These options provide control over the location of the temporary (or scratch) files of **form•Z**. These files contain information such as the undo and redo records and are hidden so that they are not accidentally deleted while the program is running. The default scratch location is the system default temporary directory, but you are allowed to specify a different location.

Use System Temporary Folder: With this on, the scratch files are stored in the systems temporary directory, the location of which varies, depending on the operating system. Consult your operating system's documentation for the exact location.

Custom: With this option a user defined location for the scratch files can be specified. When you click on the **Choose Location...** button, the **Standard Folder Selection** dialog appears, where you select the folder where the scratch files will be saved, and click on the **Choose** button. This dialog also contains a **New Folder** button, which can be used to set up a new folder. A scratch disk on RAM can be selected through this option. Note, however, that such a scratch disk should first be set at the operating system level before running **form•Z**.

Location: This information field shows the full path of the location where the scratch files will be saved. Because the scratch files are already open when the application is running, their location will change only when **form•Z** is launched again.

Current Location: This information field shows the current location of the scratch disk. This is useful since the new setting entered in the **Location** field does not take effect until **form•Z** is relaunched.



● Use System Temporary Folder

○ Custom

Location
/var/folders/2s/z_ln5d5931q05kc0bwld7dp80000gn/
T/formZ Jr x64/

Current Location
/var/folders/2s/z_ln5d5931q05kc0bwld7dp80000gn/
T/formZ Jr x64/

The Preferences dialog with the System: Scratch Disk options displayed.

Recent Files

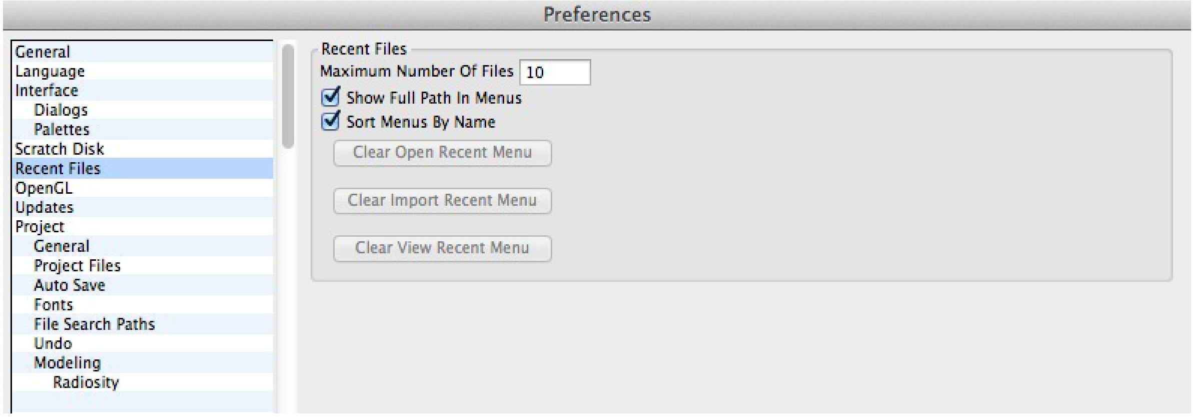
These options affect the **Open Recent** item of the **File** menu.

Maximum Number Of Files: This text field determines the maximum number of files that are remembered and shown in the **Open Recent** list. When this maximum is reached, the oldest file is “forgotten” so that a newer file can be remembered. "Old" and "new" refers to when the file was last opened or saved within **form•Z**, not when the file was created. The default is 10, the minimum is 1, and the maximum is 100.

Show Full Path In Menus: With this option, which is the default, the full path for accessing the file is shown in the menu. The full path is the complete hierarchy of the file system directory necessary to access the file. When this option is off, only the file name is shown. This option is useful for distinguishing files with the same name but different locations. If the path is too long to fit in the menu, the middle of the path is truncated.

Sort Menu By Name: When this option is on, the **Open Recent** list is sorted in alphabetic order by the file name. When off, the list is sorted by order of use, with the most recent file at the top of the menu and the “oldest” at the bottom.

Clear Open Recent Menu, Clear Import Recent Menu, Clear View Recent Menu: Clicking on one of these buttons clears the respective **Open Recent** files list. These buttons are dimmed and inactive if the respective files list is empty.



Maximum Number Of Files 10

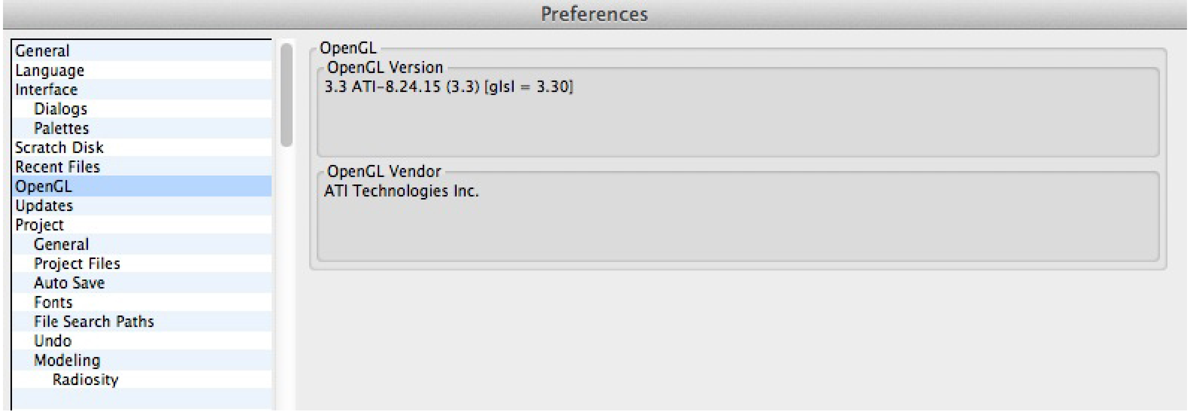
☑ Show Full Path In Menus

☑ Sort Menus By Name

The Preferences dialog with the System: Recent Files options displayed.

OpenGL

This section of the **Preferences** dialog contains information about the **OpenGL Version** and **Vendor**.



OpenGL Version: 3.3 ATI-8.24.15 (3.3) [glsl = 3.30]

OpenGL Vendor: ATI Technologies Inc.

The Preferences dialog with the OpenGL information displayed.

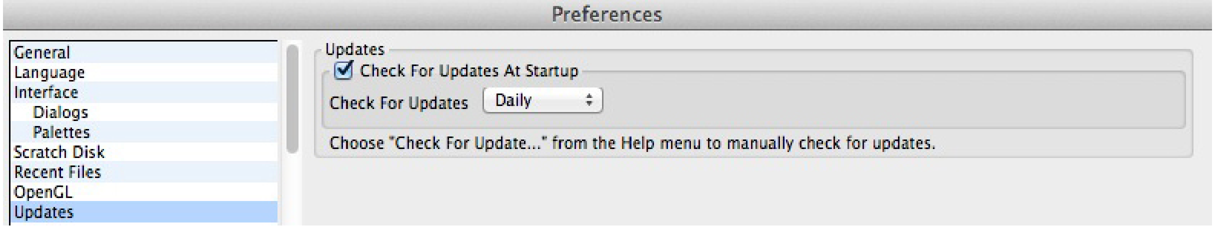
Updates

The updates manager is designed to keep users informed of new updates and versions of **form•Z**. It checks with the AutoDesSys server to see if there are any patches available for **form•Z**. If yes, it will download the patch, the **Patcher** application, and the corrections log file. It will then update **form•Z** and create a backup copy of the current version. The options in this group specify how frequently checks for updates will be made.

Check For Updates At Startup: With this option, **form•Z** checks for updates at the time it is launched.

Check For Updates: This pop up menu is only available when **Check For Updates At Startup** is on and contains three items: **Daily**, **Weekly**, and **Monthly**. Selection of one of them determines how frequently **form•Z** will check for updates when it starts up.

You can check for updates manually at any time by choosing "Check for Update" from the **Help** menu.



☑ Check For Updates At Startup

Check For Updates: Daily

Choose "Check For Update..." from the Help menu to manually check for updates.

The Preferences dialog with the System: Updates options displayed.

Preferences: Project

When **Preferences...** is selected from the **Edit** menu the **Preferences** dialog is invoked. This dialog is structured hierarchically and displays a list of categories on its left side. Clicking on an item displays the options that affect that item.

Project: General

This category of options affects new projects.

New Projects: The options in this group determine where the initial values of new projects will be coming from.

Use Defaults: With this option, the **form•Z** project defaults are used for all new projects. All of the defaults are fixed, except for the default working units.

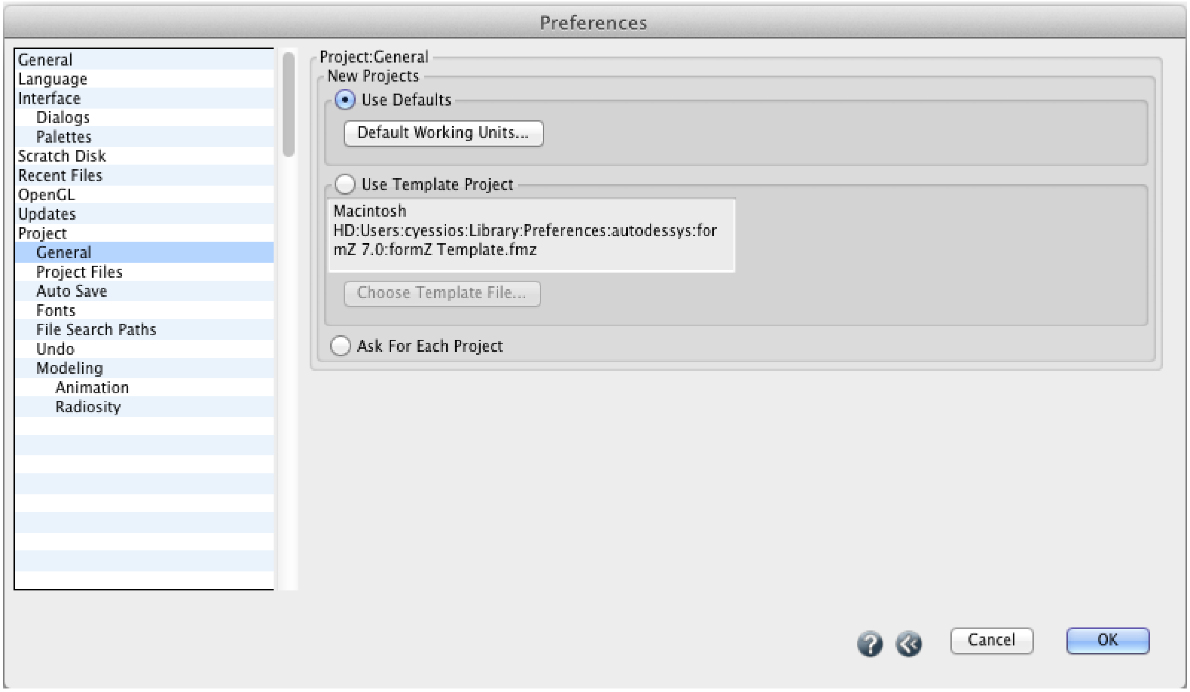
Default Working Units...: Clicking on this button invokes the Default Working Units dialog. The content of this dialog is the same as that of the **Working Units** tab of the **Project Settings** dialog, invoked from the **File** menu.

Use Template Project: With this option, the contents of a **form•Z** template file are used as defaults for all new projects. A template file is simply a previously saved .fmz file that contains your preferred starting environment. The text field of this option shows the path and name of the current template file.

Choose Template File...: Clicking on this button invokes the standard **Open** dialog for selecting the desired template file.

Ask For Each Project: With this option on, the **New Projects** dialog is invoked each time a new project is created. This dialog contains the same options as the **New Projects** group (see above in this section).

Project File Options: **Keep Backup**: With this option, a backup file is made each time you **Save** or **Save As** with the same name. The name of the backup file is made from the name of the original file and the suffix ".fzb."



● Use Defaults

○ Use Template Project

Macintosh HD:Users:cyessios:Library:Preferences:autodessys:formZ 7.0:formZ Template.fmz

○ Ask For Each Project

The Preferences dialog with the Project: General options displayed.

Project: Files

This category of options affects how a project's files are treated.

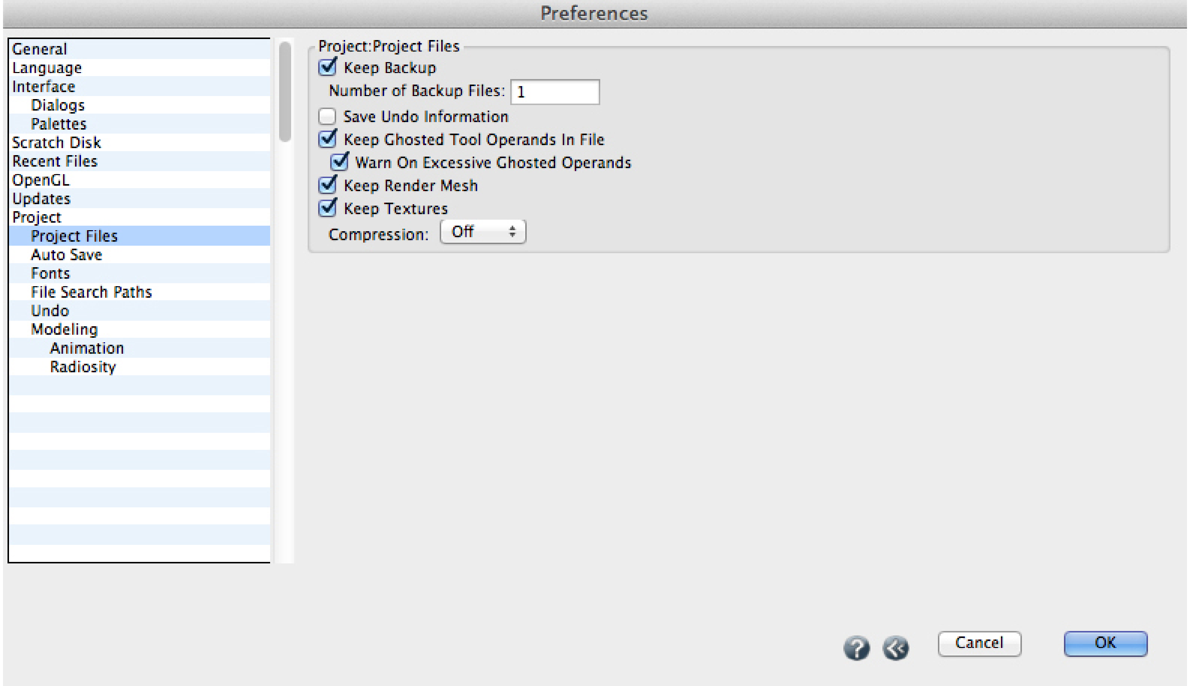
Keep Backup: When on, a backup of the project is kept and continuously updated when changes are made.

Number of Backup Files: This option controls how many backup files will be retained. The default is 1. For values greater than 1, the file name for the backup files beyond the first contains a numeric indicator of the file order. That is, for the file "bob.fzm" the backup files would be names "bob.fzb", "bob-1.fzb", "bob-2.fzb", "bob-3.fzb" and so-on. With each file save, the backup files are renamed suchs that the most recent file would always be "bob.fzb" (followed by "bob-1.fzb", "bob-2.fzb, etc.) When the desired number of backup files is reached, the oldest file is deleted.

This option is also found in the "Project Files" section of the "Project Settings" dialog.

Save Undo Information: When on, all the undo information is saved, when a project is saved, and becomes available when the project is opened again.

Keep Ghosted Tool Operands In File: Ghosted objects are created in **form•Z** in one of two ways: (a) By using the **Ghost** tool to explicitly ghost an object. (b) By being an operand in an operation that ghosts the original object after the operation is completed. Ghosted objects of type (a) are always saved when a project is saved. Ghosted objects of type (b) are only saved when this option is checked.



Project:Project Files
☑ Keep Backup
Number of Backup Files: 1
☐ Save Undo Information
☑ Keep Ghosted Tool Operands In File
☑ Warn On Excessive Ghosted Operands
☑ Keep Render Mesh
☑ Keep Textures
Compression: Off

The Preferences dialog with the Project: Files options displayed.

Project: Auto Save

With these options you can turn auto-saving on/off and specify how it will be applied. Note that the project needs to be saved at least once after it has been created in order for auto-saving to take effect. If the project still carries the Untitled label, auto-saving can not take effect.

Enable Auto Save: With this option on, the active project is auto-saved as further specified. This option is off by default.

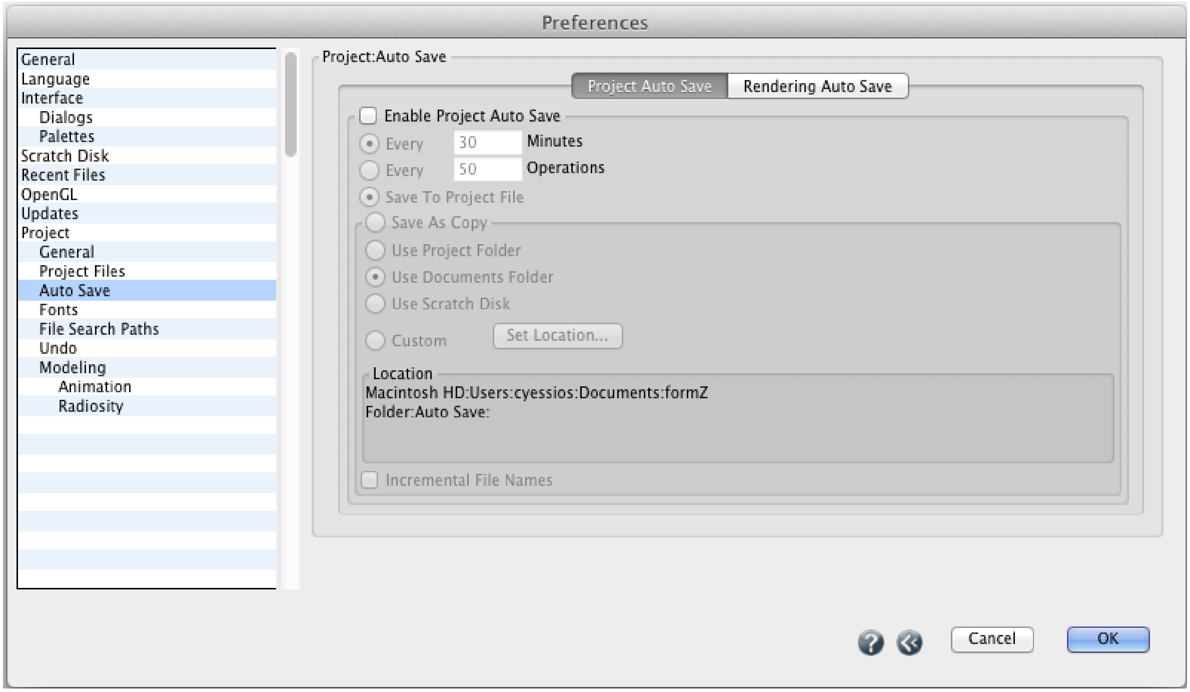
Every n Minutes: When on, auto-saving occurs every n minutes.

Every n Operations: If on, auto-saving is every n operations.

Save To Project File: When this option is on, the automatic save writes the data directly to the project file.

Save As Copy: This option creates a copy and leaves the previously saved project as is. The files are saved using the project’s name with ".sav” as the file extension. Additional options specify where the copy is saved: **Use Project Folder**, **Use Application Folder**, **Use Scratch Disk**, and **Custom**. **Use Scratch Disk** directs the auto-save files to the same location as the scratch disk. Note that Macintosh operating systems will delete the contents of the temporary folder at restart or log-out. If the scratch disk preferences are set to use the temporary folder, using this option for auto-save files may not be desirable.
When **Custom** is on, the **Set Location...** button can be used to select an existing folder for the auto-save location, or to create a new folder. The selected file name is displayed in the **Location** field below the button.

Incremental File Names: With this option, each auto-save writes a new file. Each new file’s name is created by appending the current date and time to the project’s name. File names may be concatenated, depending on the maximum file name length allowed by the system.



☐ Enable Project Auto Save

● Every 30 Minutes

○ Every 50 Operations

● Save To Project File

○ Save As Copy

○ Use Project Folder

● Use Documents Folder

○ Use Scratch Disk

○ Custom

Location
Macintosh HD:Users:cyessios:Documents:formZ Folder:Auto Save:

☐ Incremental File Names

The Preferences dialog with the Project: Auto Save options displayed.

Project: Fonts

These options allow you to specify when text fonts are loaded, as well as the locations where they can be found.

Load Fonts At Launch: When on, all the font information is loaded at startup. When off, the information is loaded the first time text is used.

Default Font: This is a pop up menu from which a default font may be selected. The default font is used when a font that is not available on the computer is used and when placing text for the first time; that is, the default font appears selected in the **Text Editor** dialog.

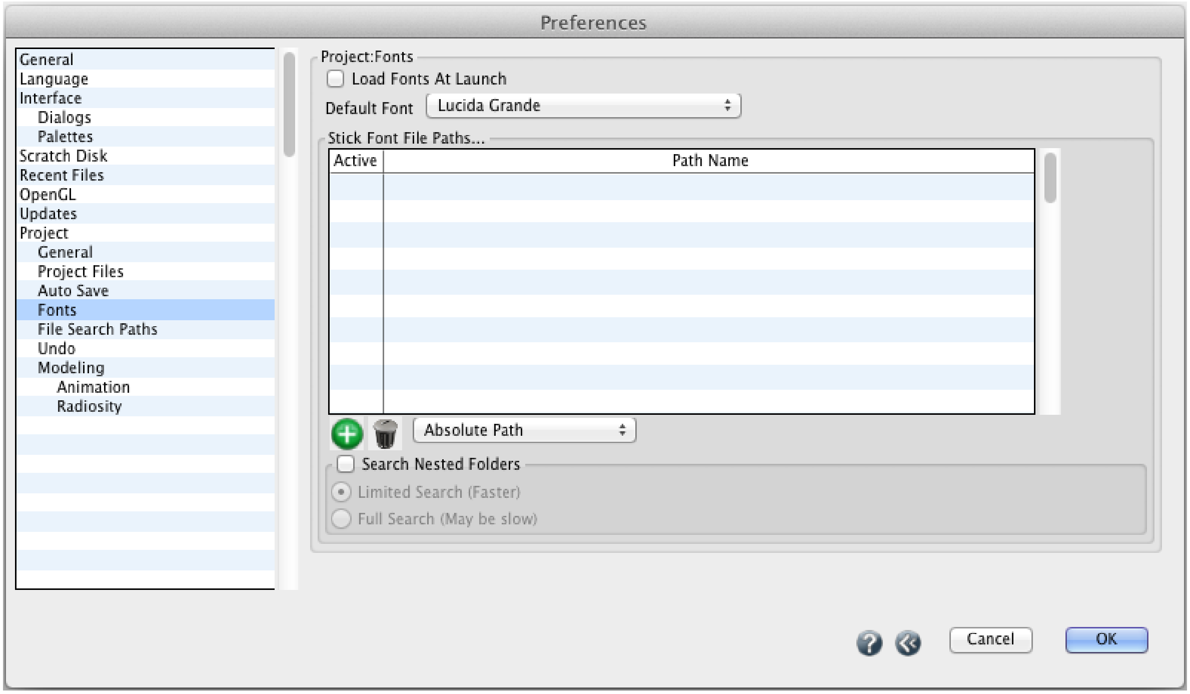
Stick Font File Paths...: This area contains a list of folders/directories that will be searched when loading Stick fonts.

Add...: This button is used to add a folder/directory to the list. Clicking on it invokes the **Select Postscript Location** dialog, which is similar to the standard **Open** dialog. After selecting the desired location, click on the **Use Current** button to add it to the list.

Remove: Clicking on this button removes the highlighted item from the list. If no item is selected or the list is empty, this button is dimmed and inactive.

Absolute Path, Relative To Application: Selecting one of these radio buttons applies the respective type to the highlighted path.

Search Nested Folders: When this option is on, the file search extends to all the folders inside the listed folder and all the folders inside them, until the desired file is found. When this option is off, the file search takes place only at the level of the folder listed in the selected search path.



☐ Load Fonts At Launch

Default Font: Lucida Grande

☐ Search Nested Folders

● Limited Search (Faster)

○ Full Search (May be slow)

The Preferences dialog with the Project: Fonts options displayed.

Project: File Search Paths

These options are used to specify the search paths (list of directories), when looking to locate an image file that cannot be found in the expected location, which is where it was at the time it was applied. By default four preset search paths initially appear that can be deleted, new paths can be added, and the attributes of paths can be changed using button commands and options available in the dialog. File search paths can be either absolute or relative. An ***absolute*** path is a complete description of the location of the directory from the top of a volume to its location. A ***relative*** path is a location based on another location. For example, if a search path is set to be relative to entity A, the search is applied to the folders contained in the folder that contains A.

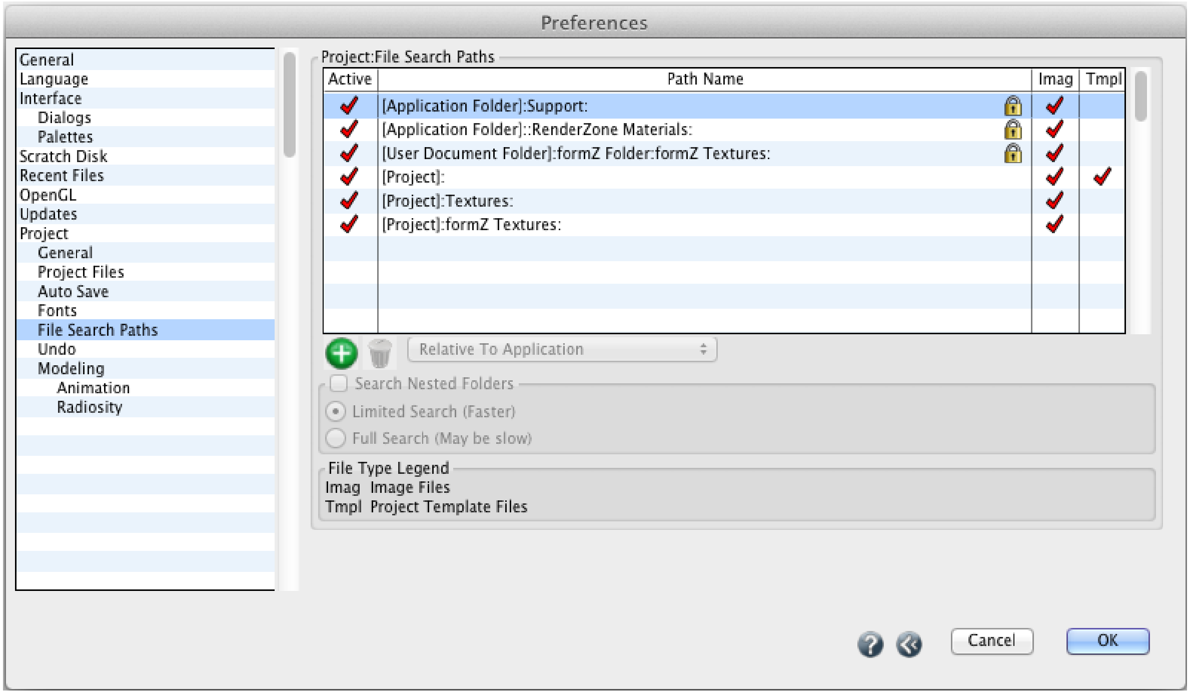
At its top, the **File Search Paths** area displays a list of the search paths. A check mark in the column on the left indicates that a path is active. Clicking in this column toggles the path between active and inactive. Inactive paths are not searched, but they remain in the list for future use. Search paths can be highlighted by clicking on them. When highlighted they can be removed or changed from absolute to relative or vice versa. Search paths also can be repositioned in the list by dragging them. Their order in the list is significant speed-wise, as the search always starts at the bottom of the list and moves upward.

Add: Clicking on this button invokes the standard folder dialog for selecting a folder. The new directory is then added to the list.

Remove: This button removes the highlighted path from the list.

Absolute Path, Relative Application, Relative To Project File: These radio buttons apply the respective type to the highlighted path.

Search Nested Folders: When this option is off, the file search takes place only at the level of the folder listed in the selected search path. When on, the file search extends to all the folders inside the listed folder, and all the folders inside them, until the desired file is found.



Project:File Search Paths

Active	Path Name	Imag	Tmpl
✓	[Application Folder]:Support: 🔒	✓	
✓	[Application Folder]::RenderZone Materials: 🔒	✓	
✓	[User Document Folder]:formZ Folder:formZ Textures: 🔒	✓	
✓	[Project]:	✓	✓
✓	[Project]:Textures:	✓	
✓	[Project]:formZ Textures:	✓	

Relative To Application

☐ Search Nested Folders

● Limited Search (Faster)

○ Full Search (May be slow)

File Type Legend
Imag Image Files
Tmpl Project Template Files

The Preferences dialog with the Project: File Search Paths options displayed.

Project: Undo

These options allow you to specify the depth of the undo records, which applies to all projects, not just the active project.

Use Undos: When on, which is the default, undo records will be kept and undos will be available. When off, undos will not be used.

Unlimited Undos: When on, which is the default, **form•Z** does not limit the number of undos that are available since the project was started.

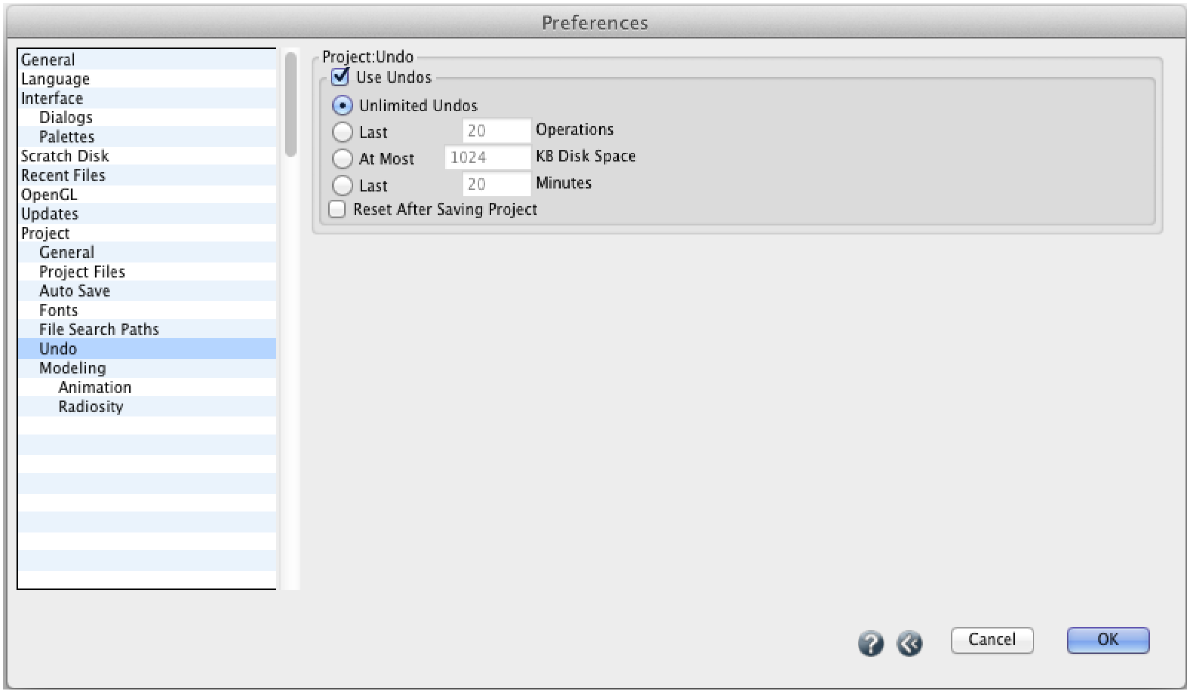
Last n Operations: When on, only the specified number of operations are available to be undone. Operations that were executed before that number of operations cannot be undone anymore.

At Most n KB Disk Space: This option allows you to limit the undo records to the specified amount of disk space. Once the limit is reached, earlier operations are overwritten and cannot be undone.

Last n Minutes: When on, **form•Z** limits the undos to operations that are not older than the specified number of minutes. Operations executed before n minutes cannot be undone.

Save Undos in Project: With this option on, the undo records are saved with the project file. When opening the project file again, the undos are available and operations executed in the previous session may be undone. Note, however, that undo records are not cross-platform and they are only available when the project is opened in the same platform (Macintosh or Windows) in which the undos were saved. The time limit for the undos applies to the accumulated time that the project was open. Note that, when undos are saved to the project file, **form•Z** cannot clean up obsolete data that may have accumulated during the session. Therefore, when this option is on, project files may grow quite a bit. Exactly how much also depends on the undo options that affect the depth of the records.

Reset After Saving Project: When on, **form•Z** resets the Undo records every time a project is saved.



Project:Undo

☑ Use Undos

● Unlimited Undos

○ Last 20 Operations

○ At Most 1024 KB Disk Space

○ Last 20 Minutes

☐ Reset After Saving Project

The Preferences dialog with the Project: Undo options displayed.

Project: Modeling

The options in this group affect a variety of modeling features.

Execute Operations Between Smooth And Facetted Objects: When the operands are both of the same type, the resulting object is also of the same type. However, when they are of a different type we need to specify what the result will be, which is done by the options in this group, which affect the insertions, Booleans, sections, trim and split operations.

Always Smooth: The result is a smooth object. This is the default.

Always Facetted: The result is a facetted object.

Facetted If Objects Have More Than n Faces: The result is facetted if it has more than n faces. It is smooth otherwise.

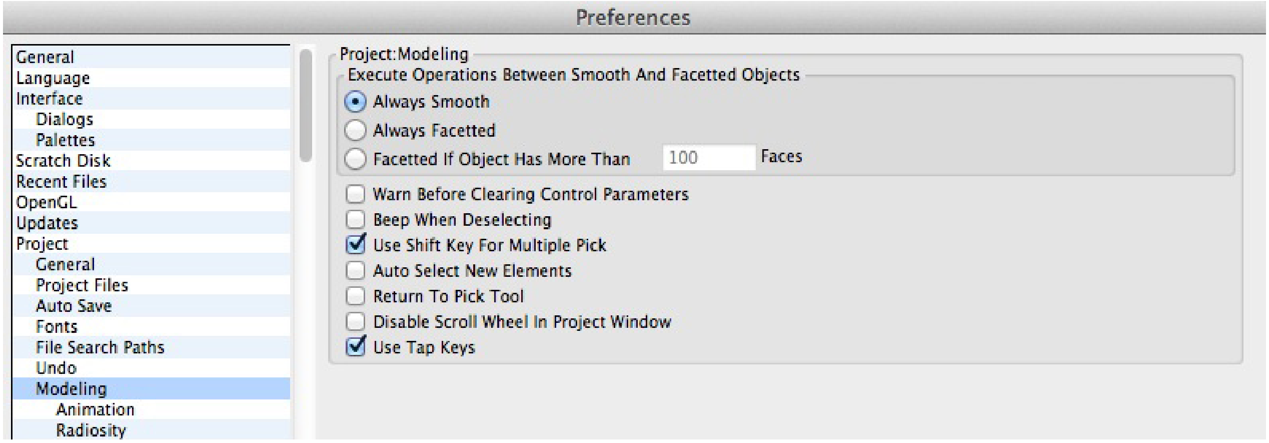
Warn Before Clearing Control Parameters: Certain operations transform the type of an object, which may cause it to loose the parameters it had for the original type. When this occurs and this option is on a warning is issued.

Beep When Deselecting: With this option on, a beep sounds when objects are deselected.

Use Shift Key For Multiple Pick: With this option on, which is the default, selection of more than one entity requires pressing the shift key. When off, multiple objects can be freely picked by simply clicking on them.

Auto Select New Elements: With this option on, all new objects, lights, etc. remain selected after they have been created.

Use Tap Keys: This item controls the **Tap** key shortcuts. This item is on by default.



Project:Modeling

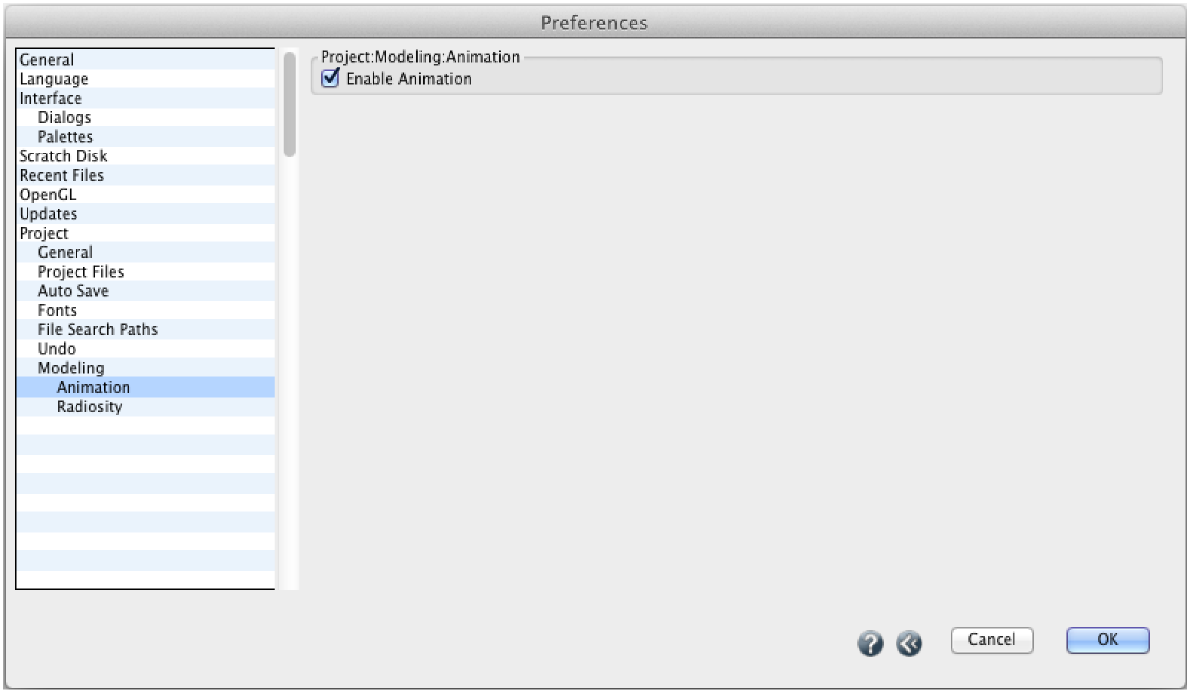
Execute Operations Between Smooth And Facetted Objects
- ● Always Smooth
- ○ Always Facetted
- ○ Facetted If Object Has More Than 100 Faces

- ☐ Warn Before Clearing Control Parameters
- ☐ Beep When Deselecting
- ☑ Use Shift Key For Multiple Pick
- ☐ Auto Select New Elements
- ☐ Return To Pick Tool
- ☐ Disable Scroll Wheel In Project Window
- ☑ Use Tap Keys

The Preferences dialog with the Project: Modeling options displayed.

Project: Modeling: Animation

There is a single option in this group that allows you to **Enable Animation** or disable it. It is enabled by default.

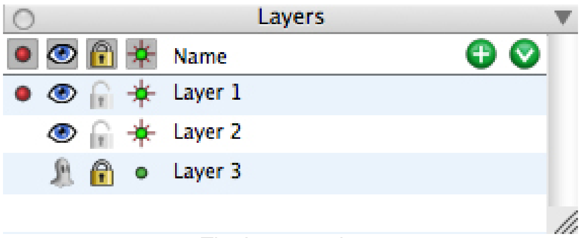


Project:Modeling:Animation
- ☑ Enable Animation

The Preferences dialog with the Project: Modeling: Animation option.

Layers

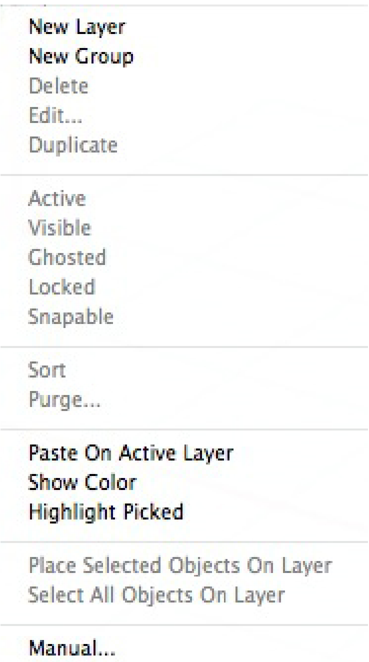
Layers essentially are a method for organizing and grouping entities within a project. Objects are automatically placed onto layers when they are generated, and then can be moved from one layer to another through the **Layers** palette located, by default, within the Palette dock to the right of the project window. It is through this palette or its contextual menu (right-click) that layers are created, managed, and deleted.



The Layers palette

The first row of the **Layers** palette (underneath the title bar) is a horizontal headers bar that contains five columns. They are (from left) **Active Layer, Visibility, Selectability, Snapability,** and **Name**. Each of these columns are as follows:

Active Layer: The red dot (●) indicates the active layer. To make an inactive layer active, simply click in the column of the desired layer. Only one layer is active at any given time. The active layer is where new objects are placed when you generate them.



Layers context menu.

The second, third, and fourth columns control three layer attributes. These can be applied individually, or simultaneously to all layers with one click in the header bar. The attributes of the layers apply equally to all the layers independently of whether they are active or not.

> **Visibility**: Clicking within this column toggles the respective layer and its objects between three states: visible (👁), ghosted (👻), and invisible (👁).
>
> **Selectability**: Clicking within this column locks (🔒) or unlocks (🔓) the respective layer. If the layer is locked, objects within the layer cannot be selected (picked).
>
> **Snapability**: Clicking in this column determines whether the system will snap to the entities of the respective layer, when one of the object snaps is active. It has two states: snapable (✳) and not snapable (●).

At the end of the horizontal header bar are the **New Layer** and **Options** buttons, as follows:

New Layer: This button (⊕) creates a new layer with a single click.

Options: Clicking on this button (⌄) invokes the palette's contextual menu that is also accessible by right-clicking anywhere inside the palette.

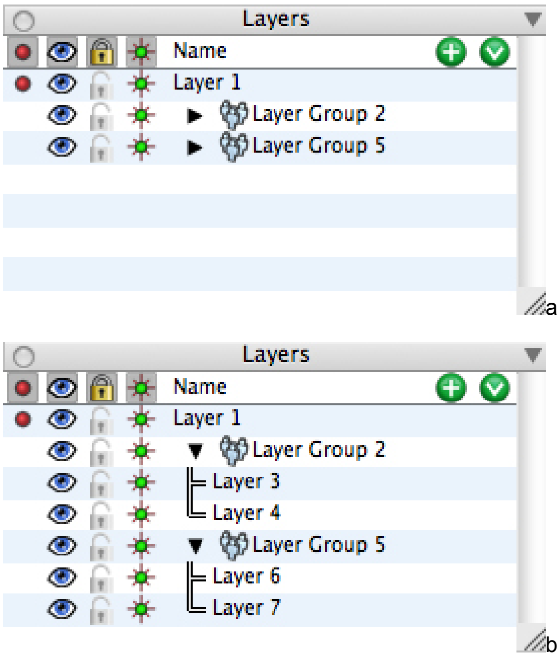
A new project contains a single active layer which bears the default name "Layer 1." It is visible, unlocked, and snapable by default. Layers created thereafter sequentially follow the same naming convention (Layer 2, Layer 3, etc.), however, the user is able to name them in the **Layers** palette as they are created.

As stated previously, objects are automatically placed onto the active layer from the time they are generated, and furthermore, can be moved from layer to layer in a variety of ways. One way is to drag the layer name (from the **Layers** palette) onto the object itself. If for example, we have a cube that is created on Layer 1 and we want it on Layer 2, all that is required is dragging the Layer 2 name onto the cube in the project window.

Another method is through the **Attributes** tab in the **Pick Tool Options** palette. With the **Pick** tool click on an object. This invokes the **Pick Tool Options** palette, which includes information about the object. One piece of information displayed in the **Attributes** tab is what layer the object is on. This is shown in a pull-down menu that contains all the currently existing layers. Selecting another layer name moves the object to that layer.

Layer Grouping

Layers can function independently, or as part of a group. Choosing **New Group** from the **Layers** palette context menu (right-click in the palette or the (⌄) button) creates a layer group. When the new group is created, it is empty (contains no layers). Clicking and dragging an existing layer onto the group name will move the layer into the group. The contained layers, or children, can be hidden or exposed depending on the direction of the triangle appearing to the left of the group name, or parent. Clicking on the triangle toggles this option. Layers can be removed from the group by dragging them outside of the group.

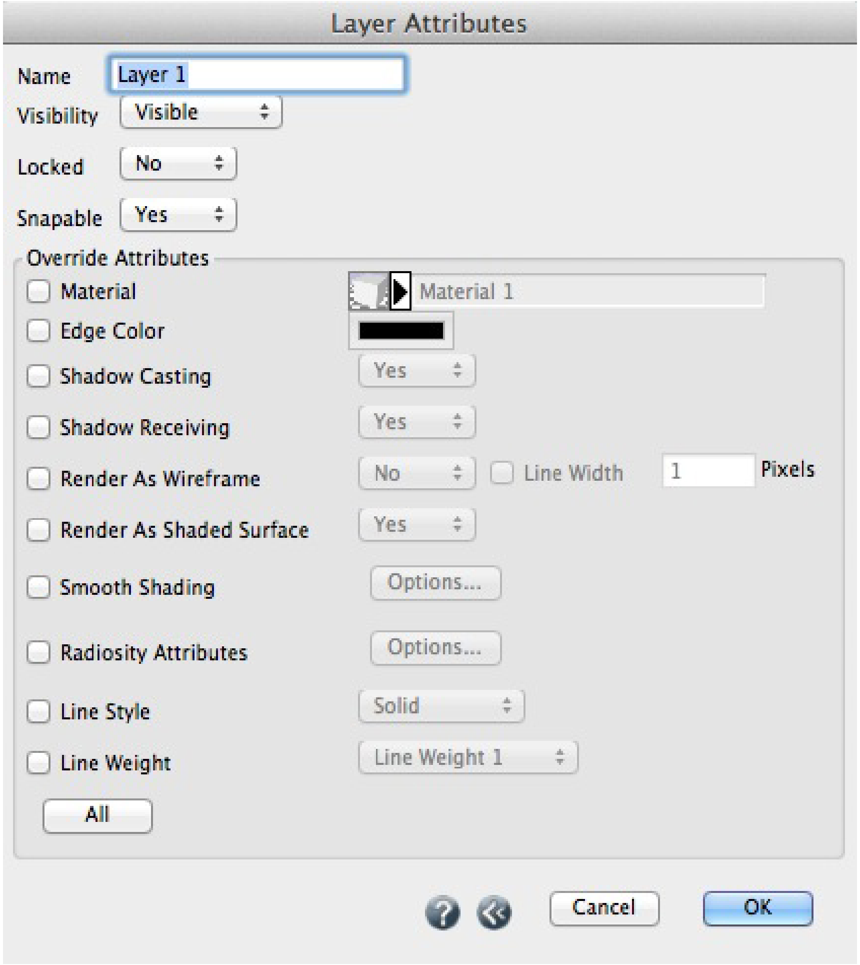


Layers palette with (a) both groups folded, and (b) both groups unfolded.

Layer Attributes dialog

Double-clicking on a layer name or selecting **Edit...** from the context menu (right-click) invokes the **Layer Attributes** dialog for that layer. Here, the layer name can be changed along with other attributes including those discussed previously (**Visibility**, **Selectability**, and **Snapability**).

Override Attributes: In this category, you are able to override object level attributes. This is accomplished by selecting the check box to the front of the attribute name. For example, if the **Material** attribute is turned on, all objects on the layer will be displayed with the material shown to the right, regardless of the object material. Other attributes include the ability to override whether objects on that layer will cast shadows, receive shadows, are rendered in wire frame or as a shaded surface, or if smooth shading is applied. Clicking the **All** button at the bottom of the category selects all these attributes simultaneously.



Layer Attributes

Name: Layer 1
Visibility: Visible
Locked: No
Snapable: Yes

Override Attributes
☐ Material — Material 1
☐ Edge Color
☐ Shadow Casting — Yes
☐ Shadow Receiving — Yes
☐ Render As Wireframe — No ☐ Line Width 1 Pixels
☐ Render As Shaded Surface — Yes
☐ Smooth Shading — Options...
☐ Radiosity Attributes — Options...
☐ Line Style — Solid
☐ Line Weight — Line Weight 1

The Layer Attributes dialog.

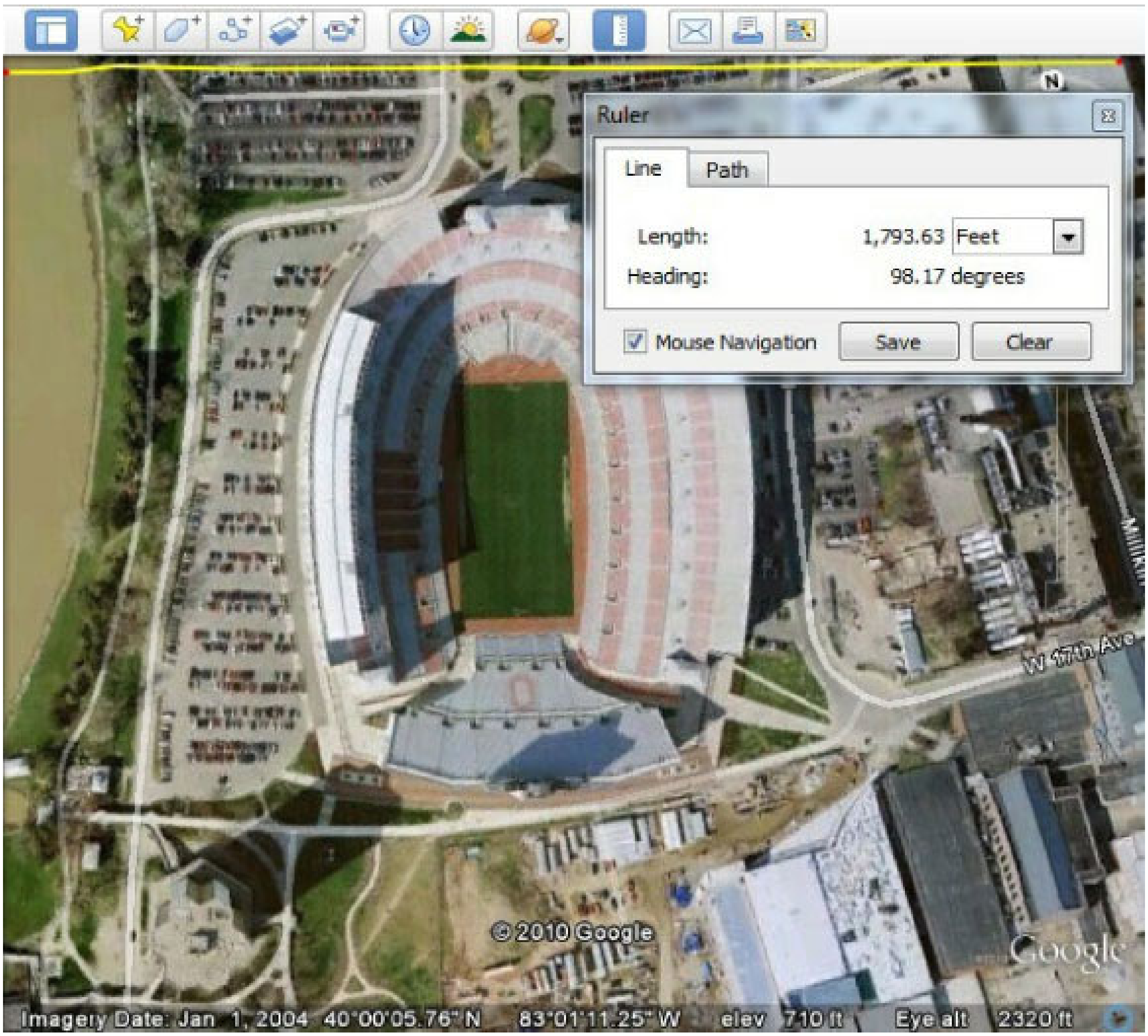
Importing images from Google Earth into form•Z

It is sometimes convenient to save an aerial image from the Google Earth application and to map it onto a flat polygon in **form•Z**. Here is how the complete process works:

- Run Google Earth and select the desired view. Press the U key shortcut to make sure that it is a top view (and the camera is vertical).

- Choose **Save: Save Image** from the **File** menu and save the file.

- From the **Tools** menu, select **Ruler** and measure the horizontal and vertical dimensions of the screen.



Length: 1,793.63 Feet

Heading: 98.17 degrees

☑ Mouse Navigation

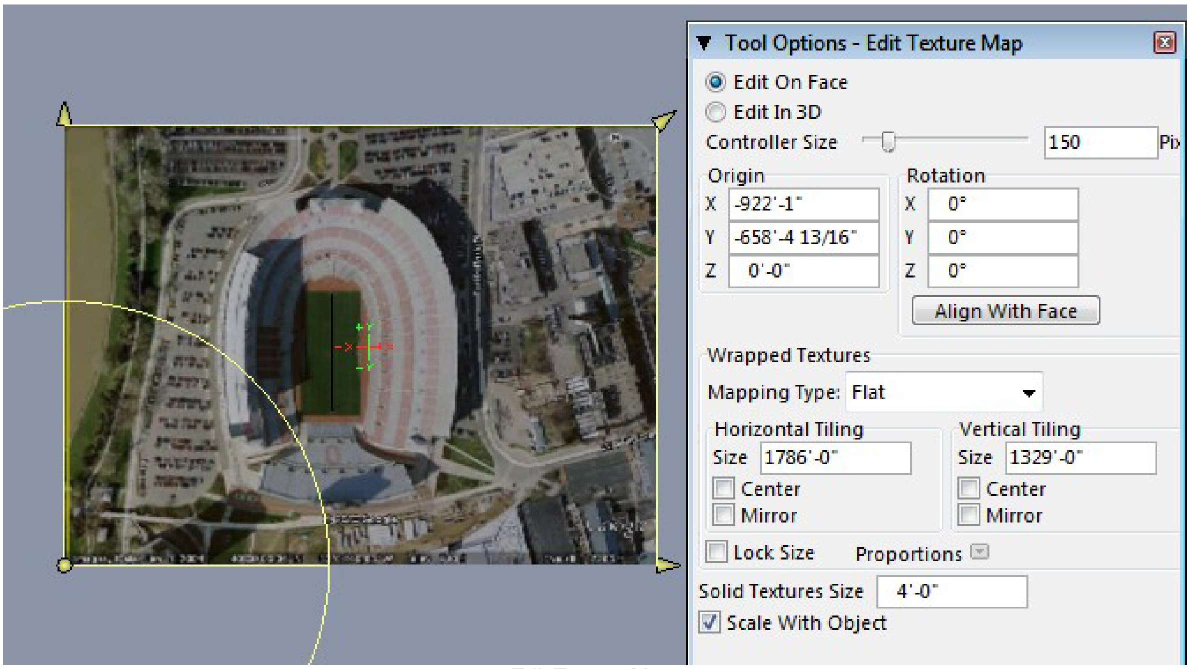
Ruler
Line
Path
Save
Clear
N
W 17th Ave
© 2010 Google
Google
Imagery Date: Jan 1, 2004 40°00'05.76" N 83°01'11.25" W elev 710 ft Eye alt 2320 ft

Google Earth Ruler.

- In **form•Z**, draw a rectangle that matches this size by clicking anywhere to start drawing and entering the dimensions in the **Input** palette at the top of the screen. Press ***enter*** or ***return*** to complete the rectangle.

- Edit the current **Material**, set the **Color** to **Texture**, and load the image you saved from Google Earth.

- Get the **Edit Texture** tool (from the **Attributes** suite of tools), click on the rectangle, uncheck the **Lock Size** option, move the corner of the texture map to the bottom left corner of the rectangle, and move the diagonal arrow to the upper right corner of the rectangle.



Tool Options - Edit Texture Map

● Edit On Face
○ Edit In 3D
Controller Size 150 Pix

Origin
X -922'-1"
Y -658'-4 13/16"
Z 0'-0"

Rotation
X 0°
Y 0°
Z 0°

Align With Face

Wrapped Textures
Mapping Type: Flat

Horizontal Tiling
Size 1786'-0"
☐ Center
☐ Mirror

Vertical Tiling
Size 1329'-0"
☐ Center
☐ Mirror

☐ Lock Size
Proportions

Solid Textures Size 4'-0"
☑ Scale With Object

Edit Texture Map.

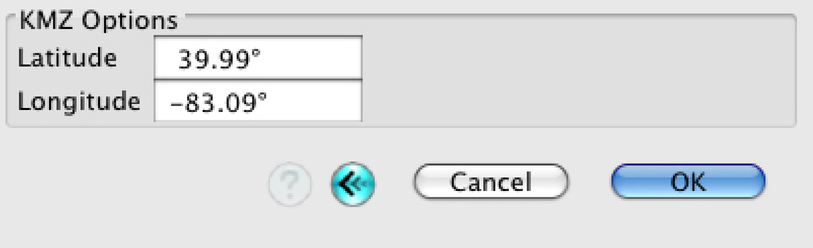
- Double-check your work by measuring a known (large) part of the site. If necessary, scale the rectangle by the appropriate factor (known size / measured size).

With the desired image loaded, the 2D flat surface it is mapped onto can be manipulated just like any other piece of geometry. You are able to create objects right on top of it, as well as cut and carve the image.

Exporting to Google Earth

A completed model can be exported and viewed in Google Earth.

From the **form•Z File** menu, select **Export**, KMZ. You can save the .kmz file to any name you choose.


KMZ Options

Latitude 39.99°

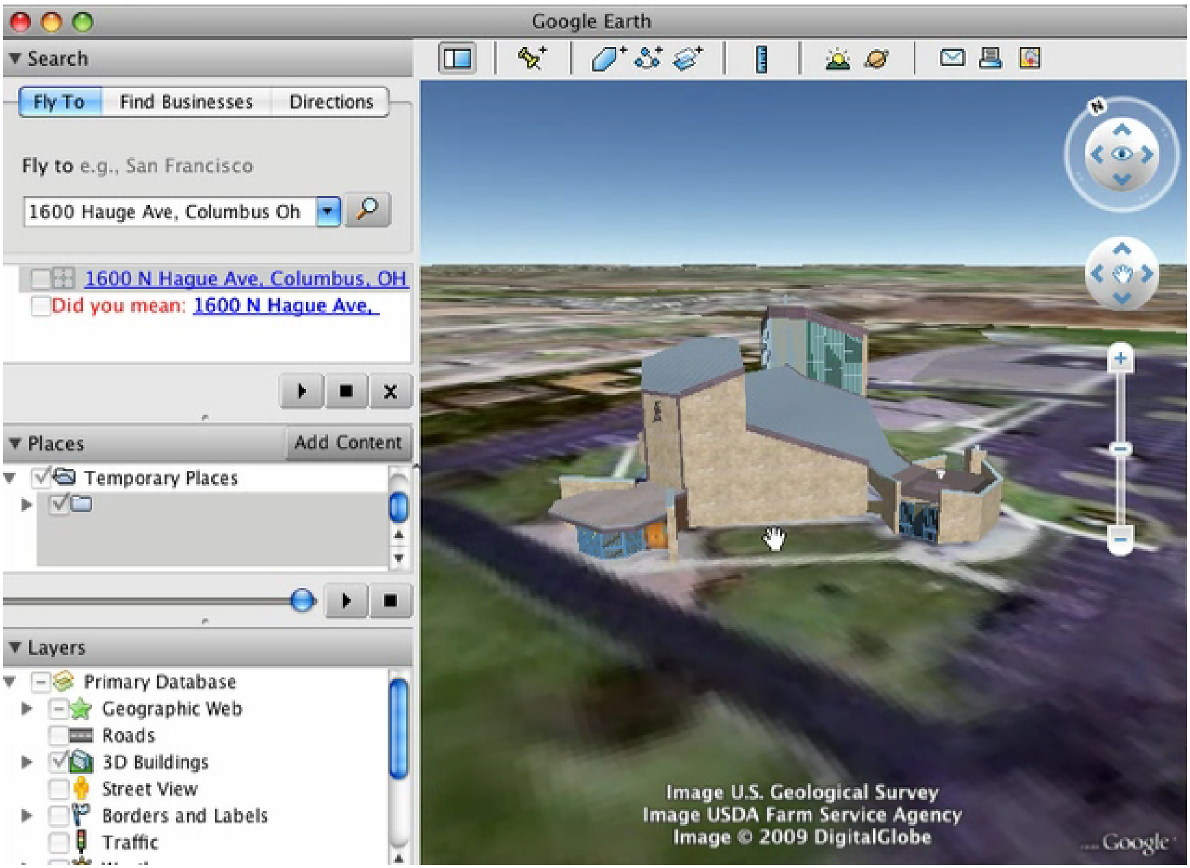
Longitude -83.09°

The Latitude and Longitude fields of the Modeling Export Options: KMZ dialog.

Inside the **Modeling Export Options: KMZ** dialog, **form•Z** automatically sets the **Latitude** and **Longitude** of the site based on the aerial image that was imported from Google Earth. Note that you can also manually type the desired coordinates of your model into these fields.

Inside Google Earth, select **File**, **Open** and locate the .kmz file you just saved and it is imported to the program. Note that, although you're now able to view your model inside Google Earth once the .kmz file is loaded, it is not made public (i.e. on a another computer). In order for someone on another computer to see your model inside Google Earth, you have two choces:

- send the .kmz file along with the image maps,
- or you can upload the .kmz file to Google's 3D Warehouse.


Fly to e.g., San Francisco

1600 Hauge Ave, Columbus Oh

1600 N Hague Ave, Columbus, OH

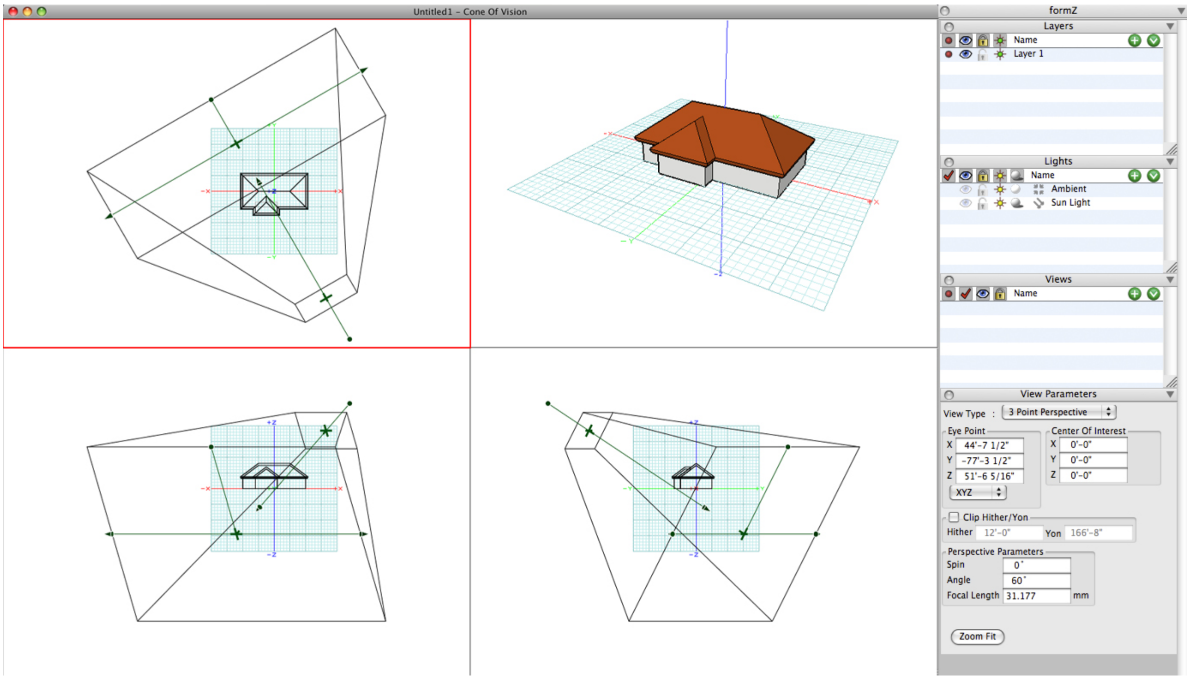
Did you mean: 1600 N Hague Ave,

A model in form•Z, exported as a .kmz file, and opened in Google Earth.

Cone of vision

The **Cone Of Vision** command at the end of the **View** menu opens the **Cone of Vision** window, through which views can be set. This is a special type of a graphics window that is subdivided in four areas, each occupying one quarter of the screen. Three of these areas function as associated windows and display orthographic projections: **top** view in the upper left portion, **front** view in the lower left, and **right** view in the lower right. These views display the modeling scene as well as the cone of vision with its controls, which can be moved in any of the three orthographic projections. The upper right area displays the 3D view, referred to as the **preview** area.

The **Cone of Vision** window works like a dialog; it remains the only active window until it is closed. When it is first opened, the upper left projection is active. Any other projection may be activated by clicking on it. The active area is marked by a red frame. The **Cone of Vision** window has most of the features of a common window, but it can not be resized or moved. It has a close box and clicking on it closes the Cone of Vision window, and returns control to the graphics window that was active at the time the Cone of Vision window was opened. The view shown in the preview area becomes the current view in the active window.



View Type : 3 Point Perspective

Eye Point
X 44'-7 1/2"
Y -77'-3 1/2"
Z 51'-6 5/16"
XYZ

Center Of Interest
X 0'-0"
Y 0'-0"
Z 0'-0"

☐ Clip Hither/Yon
Hither 12'-0" Yon 166'-8"

Perspective Parameters
Spin 0˚
Angle 60˚
Focal Length 31.177 mm

The Cone of Vision window for a perspective view.

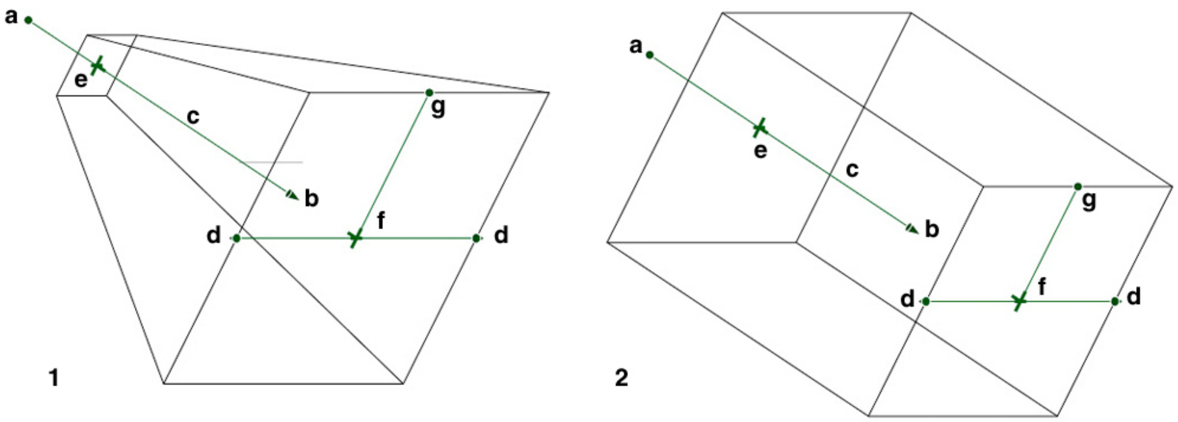
Most of the general menu bar commands remain available and can be used while the Cone of Vision window is active. They mostly affect the preview area. Also, navigation operations executable with mouse buttons are available to the projection areas.

A number of palettes are useful in the **Cone of Vision**. These palettes are found in a special dock that is present to the right of the **Cone of Vision** window. The **Layers**, **Lights**, **Views**, and **View Parameters** palettes are in this dock. As the cone is graphically edited, the parameters are updated real-time in the **View Parameters** palette.

When hitting the **Zoom Fit** button at the bottom of the **View Parameters** palette, the view is changed so that all objects in the scene are shown in the view and the **Cone of Vision** is adjusted accordingly.

All the parts of the cone of vision act as controls and can be moved in the active projection. Moving controls of the cone causes one or more of the viewing parameters to change. To move a control, click and drag the mouse. This rubber bands the affected portions of the cone and the image in the preview area is constantly updated, allowing you to visually inspect the result of the movement. When you are satisfied with the new view, one more click of the mouse freezes the view at its current state. The process of editing the view may continue by picking the same or another control of the cone of vision, in the same or another area. Picking a control in another area first activates that area, then picks the intended control and begins to move it. The controls are as follows, where the indices are also marked on the illustration:

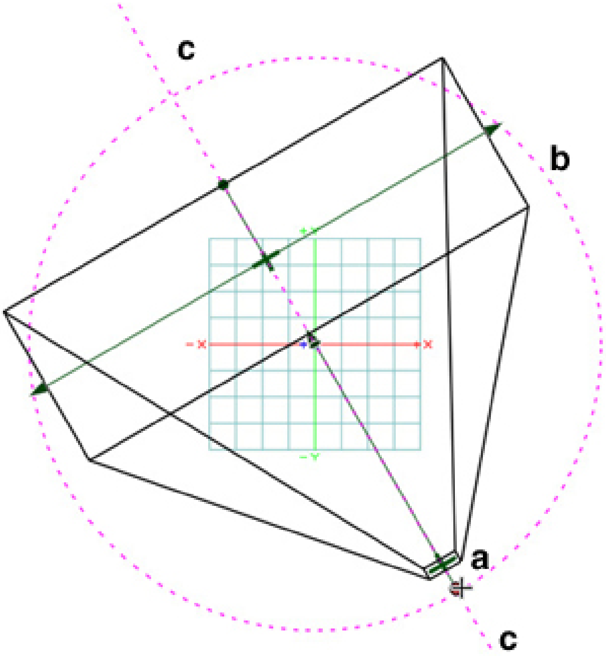
(a) The **viewer position** is the small bullet that represents the eye of the viewer. It is connected to the **center of interest** and the two together define the line of sight (see below). When the viewer position is moved, the **line of sight** is anchored at the center of interest. The viewer position may be moved along the length of the line of sight or it may be rotated around the center of interest, which affects the direction of the line of sight. The complete cone of vision follows the motion. The line of sight is always the central axis of the cone of vision and perpendicular to it are the **yon** and **hither** planes.



Controls of the cone of vision for (1) perspective and (2) axonometric: (a) viewer position, (b) center of interest, (c) line of sight, (d) view angle, (e) hither plane, (f) yon plane, and (g) view spin.

(b) The **center of interest** is picked by clicking the mouse on the small arrow at the end of the line of sight. When it is moved, the line of vision remains anchored at the viewer position. It may move along the direction of the line of sight or it may rotate about the viewer position. Its movement affects the complete cone of vision in the same fashion as the movement of the viewer position.

(c) The **line of sight** is the line connecting the viewer position and the center of interest. It is selected by clicking the mouse on or close to it. When the line of sight is moved, both the viewer position and the center of interest move together. Thus the line of sight is always moved in directions parallel to its original position. Again, the motions of the line of sight affect the complete cone of vision.



The top view window for the cone of vision: (a) viewer position, (b) viewer position circle guide, and (c) line of sight guide.

The movement of the viewer position (a), or center of interest (b) can be constrained to move along the Line of Sight by snapping it to the linear guide which appears as soon as the control is dragged.

In the top view window the viewer position (a) may also be constrained to a circle around the center of interest (b) by snapping it to the circular guide. This gives the effect of the view moving around the center of interest at the exact same distance at a constant height.

(d) The **view extent** or **view angle** is picked by clicking the mouse on one of the arrows at the bottom of the cone and behaves differently for each type of cone. In the cone for axonometric, isometric, and oblique, all four edges move parallel. This motion increases or decreases the view extent. Reducing the view extent results in a larger image and increasing it results in a smaller image. In the perspective cone, all four edges move together symmetrically, following the motion of the selected line. This motion increases or decreases the view angle. Reducing the view angle results in a larger image and increasing it results in a smaller image.

(e) The **hither plane** is picked by clicking the mouse on the cross mark at the top face of the cone, which represents the position of the hither plane. The hither plane moves only along the direction of the line of sight and cannot be moved beyond the current position of the yon plane or beyond the eye position. The hither plane represents the nearest visible point along the line of sight. When the **Clip Hither/Yon** option is selected, the rendered and hidden line images are clipped to this plane. Objects or portions of objects that are in front of this plane are invisible when clipped.

(f) Similarly, the **yon plane** is picked by clicking the mouse on the cross mark at the bottom face of the cone, which represents the position of the yon plane. The yon plane moves only along the direction of the line of sight and cannot be moved closer to the viewer position than the hither plane. The yon plane represents the farthest visible point along the line of sight. When the **Clip Hither/Yon** option is selected the rendered and hidden line images are clipped to this plane. Objects or portions of objects that are behind this plane are invisible when clipped.

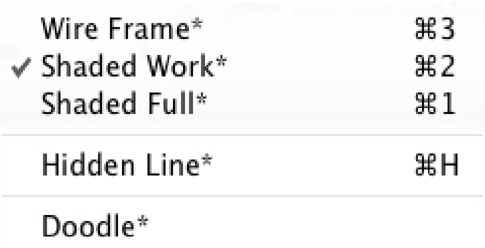
(g) The **view spin** is changed by clicking the mouse on the bullet at the bottom of the cone. When picked, the cone is dynamically rotated around the line of sight. This has the effect of tilting the viewer’s head and looking at the modeling environment sideways. The bullet is connected with a straight line to the center of the yon plane. This line represents the “up” direction of the view. It is parallel to the vertical sides of the image.

As already mentioned, many of the menu bar commands remain available to the **Cone of Vision** environment and can be used, with their action being frequently adjusted to the semantics of the cone of vision. For example, the **Undo** and **Redo** items affect the view manipulations that have occurred within the cone of vision environment. All the display and the view type setting commands affect the 3D preview area only and none of the three projection areas. The **Synchronize** command can be used to align and scale the views of the cone of vision three projection areas.

Display Methods

form•Z offers fourmethods for displaying the images of 3D models, accessed through the **Display** pull down menu or the **Display Tools** palette ( ). More methods may become available through extensions (plugins).

The first three—**Wire Frame**, **Shaded Work**, and **Shaded Full**—are grouped together because they function in real time, designed to perform interactively as you model. The **Hidden Line** display method is grouped separately because it provides static renderings, intended more for visualization.



form•Z display methods as they're grouped in the Display pull down menu.

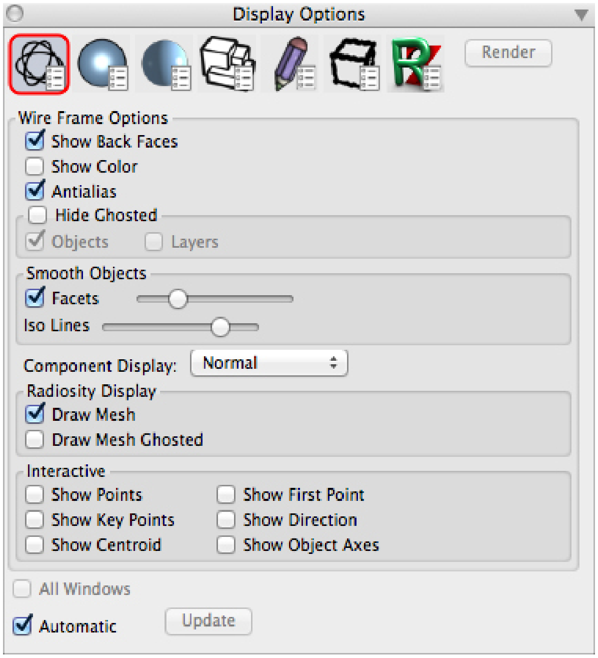
When one of the display methods is selected, it becomes the active display method and the graphics window is redrawn using the selected method. Generally, the speed and the quality of a display mode are inversely analogous.

The display methods are controlled by optional parameters set through the **Display Options** palette. Options inside the palette vary depending on the currently active display mode. Two other methods for accessing these options are as follows:

- hovering the cursor over the display mode icon,
- or clicking on its (**Display**) menu item while pressing **option** (Macintosh) or **ctrl+shift** (Windows).

Wire Frame

This mode displays a wire frame line drawing in the active window. A wire frame shows all the lines or edges of objects. Since no effort is made to eliminate the lines that are behind surfaces, it is the fastest display method. Its display options palette is divided into two tabs as follows:



Wire Frame Options
☑ Show Back Faces
☐ Show Color
☑ Antialias
☐ Hide Ghosted
☑ Objects ☐ Layers

Smooth Objects
☑ Facets
Iso Lines

Component Display: Normal

Radiosity Display
☑ Draw Mesh
☐ Draw Mesh Ghosted

Interactive
☐ Show Points ☐ Show First Point
☐ Show Key Points ☐ Show Direction
☐ Show Centroid ☐ Show Object Axes

☐ All Windows
☑ Automatic

The Wire Frame Options palette with the Wire Frame tab selected.

Wire Frame Display options

Show Back Faces: When this option is on, the back facing faces of objects are plotted or rendered. They are not if this option is off.

Show Color: When selected, all objects are shown with the color that is assigned to them. Faces that may have been assigned different colors are also shown in the color assigned at the object level. When off, all objects are plotted in black when the background color is light, or in white when the background is dark. The default is on.

Antialias: When on (default), the wire frame lines are antialiased.

Hide Ghosted: When this option is on, ghosted entities are not shown. They are shown in the project's ghost color (gray by default), when this option is off. This option can be applied to either **Objects** or **Layers** or both, depending on the selection from the two options under it.

Smooth Objects: The two options in this group control whether the facets, the wires, or both are displayed for smooth objects.

Facets: When this option is on, facets are also shown for smooth objects, in addition to their iso lines. When shown, the color intensity of facets can be set using the slide bar next to this option. By default, the intensity of facets is lighter than that of the iso lines.

Iso Lines: This slider bar is used to set the intensity of the color of the iso lines. Note that, while **Facets** can be turned on/off, the **Iso lines** are always on. However, their color intensity can be set low enough to make them virtually invisible.

Component Display: This pop-up menu contains three items that affect how components are displayed: **Normal, Bounding Box,** and **Dashed Box**.

The options in the **Interactive** group determine whether some of the characteristics of objects are explicitly shown:

Show Points: When this option is on, the points (vertices) of the displayed objects will be marked with a diamond.

Show Key Points: When this option is on, the key points for the object curve are shown as small dots on the screen.

Show Face Normals: Note this option is no longer a **Wireframe** display option, it is now found in the **Tool Options** palette as an attribute for an object(s) that is(are) currently selected. Information regarding **Show Face Normals** can be found in the **Picking** section of this manual.

Show Object Axes: When this option is on, the axes of each object in the modeling scene are displayed. When they are displayed, point snapping to the axis origin is also available.

Show View/Camera Cones: When this option is on, the camera view cones are displayed.

Show Light Color: When this option is selected, each light is drawn in the light's color. If this option is off, which is the default, the lights are drawn in black.

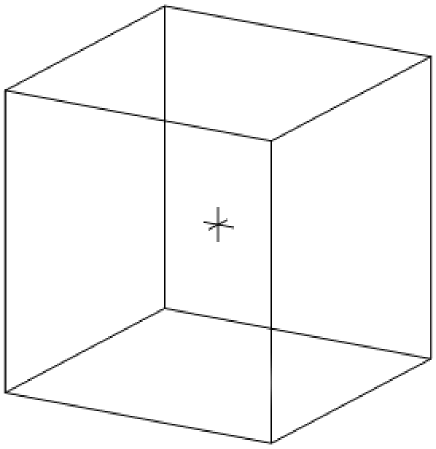
2D Surface Objects: These two options control whether certain structural details (first point and direction) will also be marked when surface objects are plotted.

Show First Point: When this option is selected, the first points of surface objects are marked with a diamond shape when plotted.

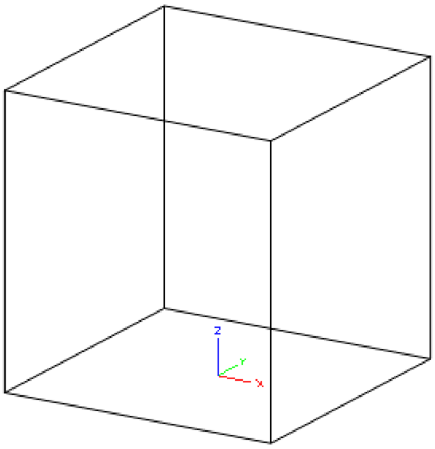
Show Direction: When selected, the directions of surface objects are shown by displaying arrows placed at the middle of each segment. With consecutive small segments, arrows are placed at intervals. These options are quite useful for operations that are sensitive to directions.

Show Centroid: The object centroids are generated at default positions at the time objects are created. Their positions and orientation follow the object as it is transformed. When the **Show Centroid** option is on, the centroid of each object is displayed as a 3D cross and is available for point snapping.

Show Object Axes: The object axes are generated at default positions at the time objects are created. Their positions and orientation follow the object as it is transformed. When the **Show Object Axes** option is on, the object axes of **each object in the modeling scene** are also displayed. Note that when this option is on, it overrides the per object axes Attribute, when this option is off, the per object Attribute prevails. when object axes are displayed, they are also available for point snapping.



Show Object Centroid



Show Object Axes

All Windows: When this option is selected, the current **Wire Frame** options are applied to all the windows of the project. This option is off by default.

Automatic: With this option checked, after every change you make in the **Display Options** palette, the display is refreshed to reflect the changes. If this option is off, you need to press **Update** any time you wish to see your changes applied to the display. **Automatic** is on by default for the interactive display modes (**Wire Frame, Shaded Work, and Shaded Full**). It is off by default for the other display modes.

Shaded Work

As the default display mode in **form•Z**, **Shaded Work** displays an OpenGL based shaded rendering in the active window. It is designed for working with unified lighting. A single light source is used from the vantage point of the viewer. This "head-mounted" light allows for the model to be worked on regardless of how the model is viewed. The lights listed in the **Lights** palette are not used in this display method.

The **Shaded Work Options** palette contains these options:

Edges Of Solids/Surfaces: When this option is on, the edges of the faces are also visible.

Isolines: When on the isolines of smooth objects are displayed.

Silhouette Edges: This is only available when the **Show Edges** option is selected. When on, this option increases silhouette lines of objects by two pixels. As a result, the silhouette edges of objects appear thicker compared to interior edges, making it easier to identify objects.

Wire Objects: This option allows the **Silhouette Edges** feature to display with wire objects.

Antialias and **Line Scale** as for **Wire Frame**.

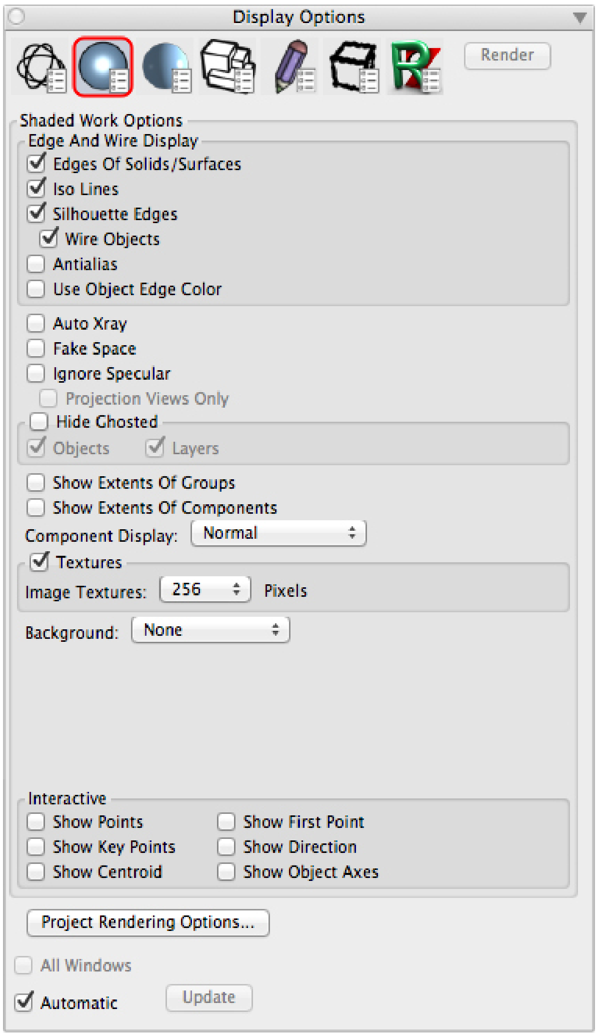
Use Object Edge Color: This option is available only when the edges are shown. When on, the edges are assigned the color of the object. Otherwise they are black on a light background and white on a dark background.

Auto Xray: When on, this option allows you to see through existing objects as you draw behind them. In the example shown, faces of the existing cube (the larger one) are momentarily transparent while a second smaller cube is being created behind it. Once the background object is complete, the foreground object returns to its normal, solid appearance.

Fake Space: When on, this option allows you to see on-screen graphics that would otherwise be obscured by depth. The **Fake Space** example shown illustrates this option. Although the polygon is positioned behind the cube, the temporary reference plane is visible in its entirety while drawing on the obscured face.

Ignore Specular: As the **Shaded Work** mode uses a single light source positioned at the viewer's location (a.k.a. head lamp), the specular effect, when looking straight at an object, causes the color to be washed out. When this option is on, the objects are displayed without the specular component. When **Projection Views Only** is on, the suppression of specular will occur only in projection views, where it is most noticeable.

Hide Ghosted: As for **Wire Frame**.



Shaded Work Options

Edge And Wire Display
☑ Edges Of Solids/Surfaces
☑ Iso Lines
☑ Silhouette Edges
  ☑ Wire Objects
☐ Antialias
☐ Use Object Edge Color

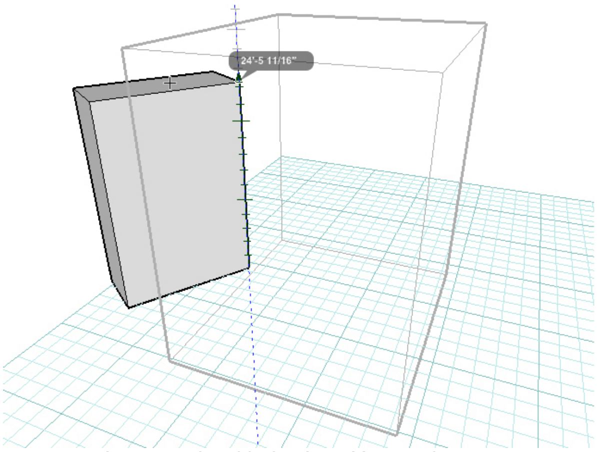
☐ Auto Xray
☐ Fake Space
☐ Ignore Specular
  ☐ Projection Views Only
☐ Hide Ghosted
☑ Objects ☑ Layers

☐ Show Extents Of Groups
☐ Show Extents Of Components
Component Display: Normal
☑ Textures
Image Textures: 256 Pixels
Background: None

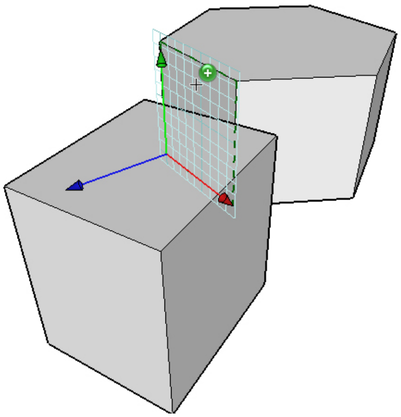
Interactive
☐ Show Points ☐ Show First Point
☐ Show Key Points ☐ Show Direction
☐ Show Centroid ☐ Show Object Axes

☐ All Windows
☑ Automatic

The Shaded Work Options palette with the Shaded Work tab selected.



An example with the Auto Xray option on.


An example with the Fake Space option on.

Show Extents of Groups: With this option active bounding boxes will be drawn around groups.

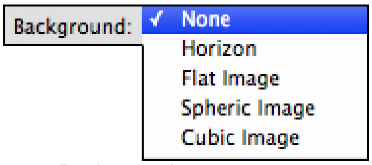
Show Extents Of Groups, Show Extents Of Components: When on, a dashed bounding box is displayed containing the members of a group or component.

Component Display: As for **Wire Frame**, except that the pop-up menu here contains an additional item: **Transparent Box**.

Textures: When this option is on, **Shaded Work** displays the textures for objects that have been assigned image based or procedural textures. The texture is determined by the color component of the material. If the material contains a texture in its transparency component, this texture will be included if the above **Transparencies** option is selected.

Image Textures n Pixels: This menu determines the maximum desired size for texture maps. If the maximum dimension of a texture (used by a material's color map or transparency map) exceeds this size the texture is reduced to the specified dimension. This option prevents large textures from consuming significant memory on the graphics card. Smaller numbers perform better, but will look less desirable.

Background: Through this pop up menu, you are able to establish a background for the scene. It contains five items; the latter three of which set the background through an image file and specify how it will be mapped.



Background pop up menu.

None: When this item is selected, which is the default, the background is set to a uniform color. This color can be changed through the **Appearance** tab of the **Project Settings** dialog (**File** menu).

Horizon: When this item is selected, a basic horizon is added to the scene. The background color is the ground or Earth, while another color represents the sky. This color can be changed by clicking in the color box that appears once **Horizon** is selected from the **Background** pop up menu.

Flat Image: When this item is selected, a flat image is mapped onto the background. This image remains static, regardless of the current view. A thumbnail of the current image is shown. To select a different background, click on the icon to invoke the **Flat Image** dialog. This dialog presents more information about the image. Clicking the **Load...** button invokes the standard **Open File** dialog from where you can choose an image file.

Fit in Window: This option sizes the background image to fit the size of the window. If this option is off and the image is smaller than the window, the image will be tiled. If larger, the image will be clipped.

Spheric Image: When this item is selected, the currently loaded background image is mapped onto an imaginary sphere that surrounds the scene. The image is wrapped around the sphere in such a way that the horizontal direction of the image runs parallel to the equator of the sphere. The background image is selected and displayed as with **Flat Image** discussed previously.

Cubic Image: When this item is selected, the background image is mapped onto an imaginary cube that surrounds the scene. The loaded background image is selected and displayed as with **Flat Image** discussed previously.

The options in the **Interactive** group of options are as for **Wire Frame.**

Project Rendering Options...: This button invokes the **Project Rendering Options** dialog discussed in the following section.

All Windows: As for Wire Frame.

Shaded Full

This OpenGL based display method offers additional features, such as shadows. While less interactive, it provides a more accurate representation of the model. Unlike **Shaded Work**, it uses the lights from the **Lights** palette for its illumination. Nearly all the options for this mode are as for **Shaded Work**, except for the following:

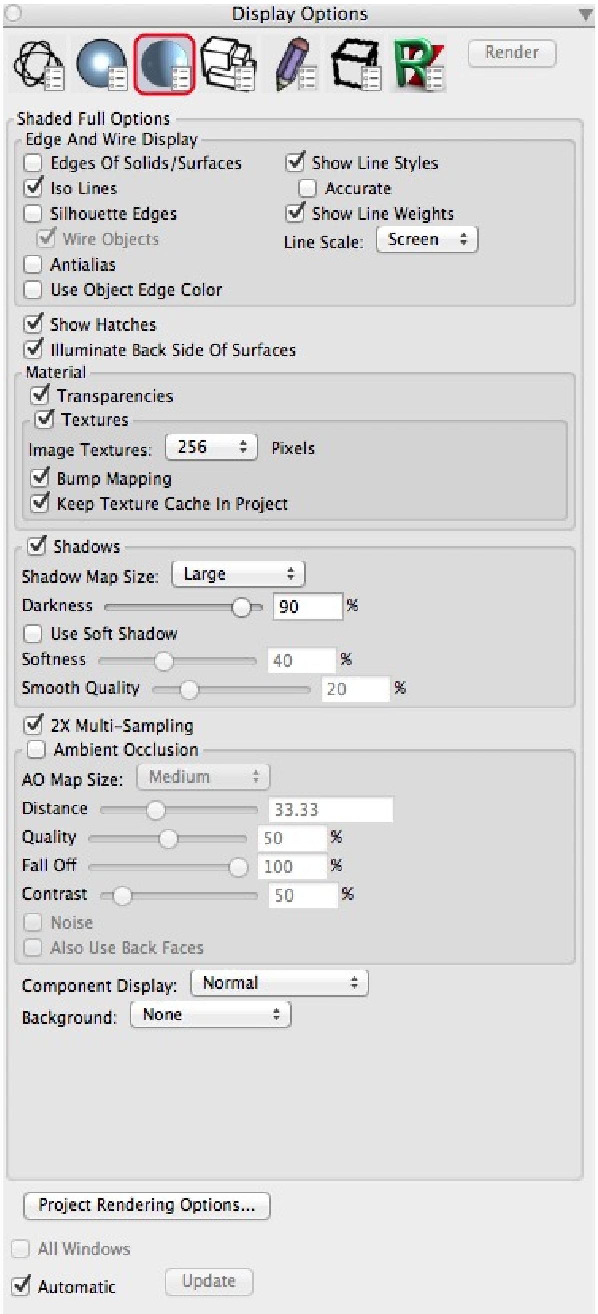
Illuminate Back Side Of Surfaces: When this option is on (default), faces of surface objects that face away from light sources are illuminated as if they were facing the light (i.e. reversed). Thus the face directions of surface objects do not affect the rendered image.

Transparencies: When this option is selected, objects to which transparent materials are assigned are rendered transparent. The degree of transparency is as set in the respective material. Recall that 0% and 100% transparencies result in opaque and invisible objects, respectively.

Bump Mapping: When this option is enabled, bump maps are shown in the on-screen rendering for materials that have bump maps defined. This feature improves the depth effect of the material but makes the rendering a bit slower.

Shadows: When this option is on, objects whose shadow attribute is on cast shadows from the light sources whose shadow option is on, onto objects whose shadow receiving attribute is on. Recall that the shadow casting and receiving attributes of objects are on by default when objects are created. The shadow option of lights also is on by default.

Shadow Map Size: Shadow maps have controls that you can use to determine the **Shadow Map Size** used, and thus the quality of the shadow's edges. The shadow map size can be set to be: **Small**, **Medium**, **Large, Very Large,** and **Massive**. **Small** will create shadows that have a low resolution, meaning that they can be good for performance, but also show a lesser edge quality. The larger shadow map settings use a higher resolution map, and the edges of the shadows are of higher quality. Increasing the **Shadow Map Size** will affect project window performance, so you can switch to a lower map resolution for working, and use a higher one for presentations and animations.



Shaded Full Options

Edge And Wire Display

☐ Edges Of Solids/Surfaces
☑ Iso Lines
☐ Silhouette Edges
☑ Wire Objects
☐ Antialias
☐ Use Object Edge Color
☑ Show Line Styles
☐ Accurate
☑ Show Line Weights
Line Scale: Screen

☑ Show Hatches
☑ Illuminate Back Side Of Surfaces

Material

☑ Transparencies
☑ Textures
Image Textures: 256 Pixels
☑ Bump Mapping
☑ Keep Texture Cache In Project

☑ Shadows
Shadow Map Size: Large
Darkness 90 %
☐ Use Soft Shadow
Softness 40 %
Smooth Quality 20 %

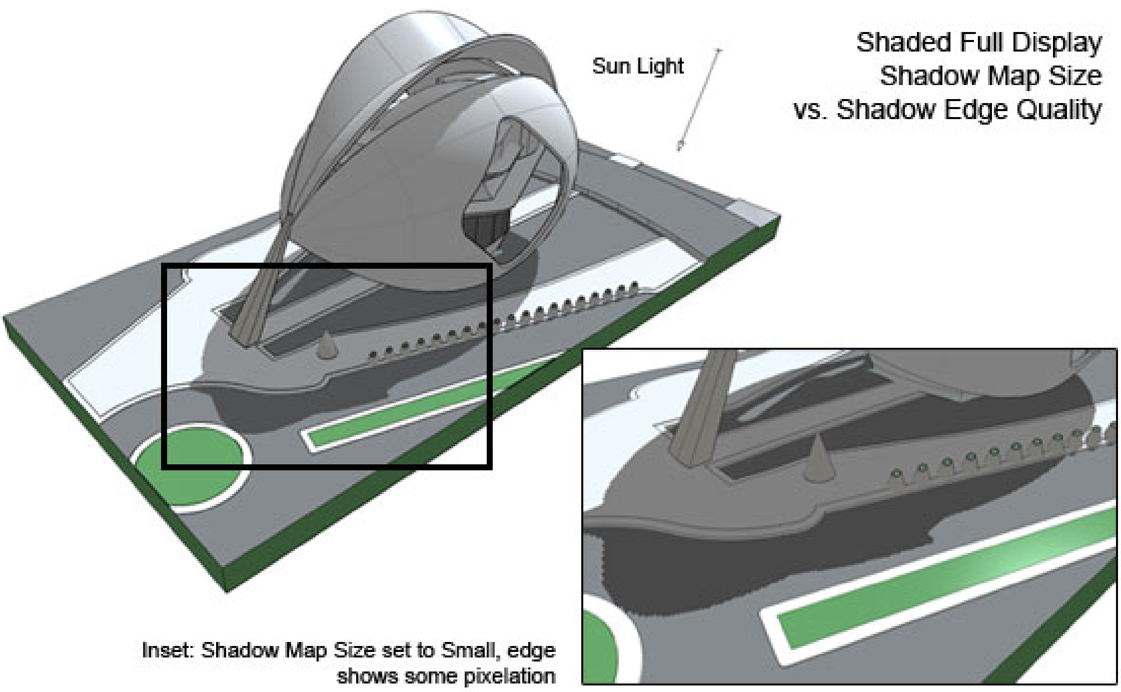
☑ 2X Multi-Sampling
☐ Ambient Occlusion
AO Map Size: Medium
Distance 33.33
Quality 50 %
Fall Off 100 %
Contrast 50 %
☐ Noise
☐ Also Use Back Faces

Component Display: Normal
Background: None

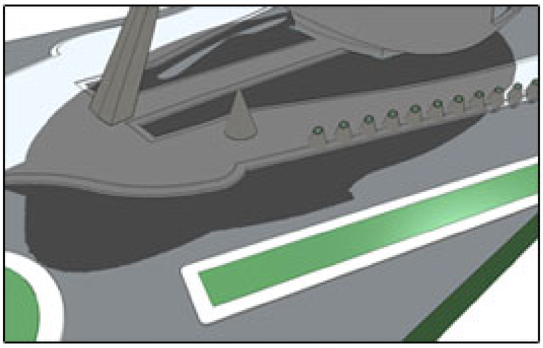
☐ All Windows
☑ Automatic

The Display Options palette with the Shaded Full tab selected.

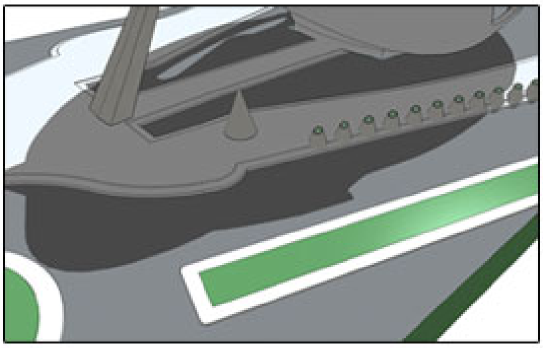
Darkness: this slider determines how much light is blocked by the objects casting shadows. When the slider is at the far left, the value of shadow is 0%, and no shadow is cast. When the slider is to the far right, the value of shadow is 100%, and a very dark shadow is cast. Adjusting the slider to values in between these extremes determines how dark the shadows will appear.



Inset: Shadow Map Size set to Small, edge shows some pixelation



Inset: Shadow Map Size set to Medium, edge shows less pixelation



Inset: Shadow Map Size set to Large, edge shows minimal pixelation and is very smooth

Use Soft Shadow: This checkbox activates **Soft Shadows** and presents the controls for **Softness** and **Smooth Quality.** Soft Shadows show a blurred or feathered edge, and as such appear to come from the Sun on an overcast day. Soft Shadows work in conjunction with Shadow Map Size, which was discussed previously. Soft Shadows will look better when used with a larger shadow map.

> **Softness**: This slider determines the value used to feather the shadows. A value of 0% means that there will be no feathering, while a setting of 100% will be feathered to it's maximum extent. Adjusting the slider to values in between these extremes determines the actual amount of feathering used.
>
> **Smooth Quality**: This percentage slider determines the value used for the number of samples the soft shadow will use. A low value will show "stair-stepping" or appear to be a series of shadows, while a high value will use enough samples that a smooth gradient is achieved.

2X Multi-sampling: When this option is enabled a sampling technique is used to make edges appear sharper on screen. Technically, it is rendering the project window at twice the resolution, and then shrinking the image down to the resolution it appears on the screen. This feature can make perfomance slower, so it is likely best used during presentations and animations rather than while modeling in the window.

Ambient Occlusion: This is a feature that "darkens corners" in real-time. In real life, there is a visual phenomenon in which light is "occluded" from getting into the corners of a room more than open areas of the wall, and so the wall surface appears to gradually get darker as it approaches the corners. **Ambient Occlusion** mimics this phenomenon, and does so in real time. The appearance of the Ambient Occlusion

AO Map Size: This option controls maps similar to shadow maps to determine the initial quality of the occlusion. If a **Small** map size is selected, then the appearance of the darkened corners may show artifacts, if this is the case, choose **Medium, Large, Very Large,** or **Massive** to improve the result.

Distance: This slider sets the value that **Ambient Occlusion** "reaches out" from the corners of the objects in the project window. You can think of this distance as the maximum reach of the AO gradient. A good value for interiors, for example, is between 30" and 36".

Quality: This percentage slider determines the fidelity of the **Ambient Occlusion**. A high setting will show very smooth **AO** gradients proceeding from the corners, while lower values may show artifacts and "stair-stepping".

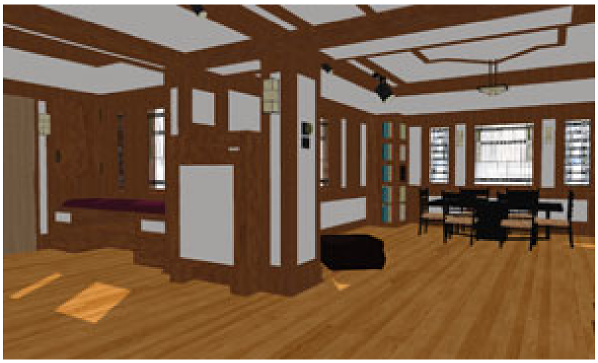
Falloff: This percentage slider determines whether the **AO** gradient changes abruptly or very subtly. If the slider is to the left, there will be a narrow band of darkness in the corners, if it is to the right hand side of the slider, it will use more of the specified **Distance** for the **AO** gradient. A higher value results in a smoother transition than a lower value.

Contrast: This percentage slider determines how dark the **Ambient Occlusion** will be. A value of 0% will show no **Ambient Occlusion** at all, while a value of 100% will make the **Ambient Occlusion** very dark. Choosing a value between the two extremes produces intermediate results, and can be further tweaked as needed.

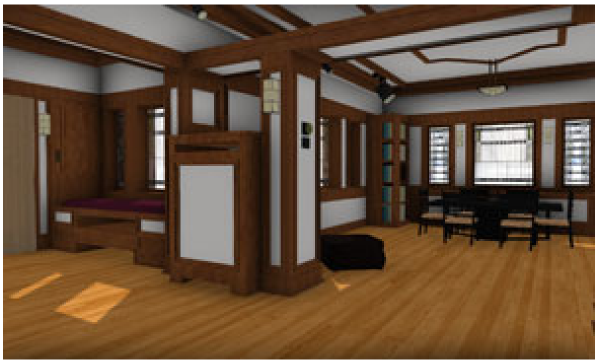
Noise: This option causes the **Ambient Occlusion** to be rendered with a subtle stipple pattern that enhances the hand drawn look of the display.

Also Use Back Faces: This option causes the back faces of objects to be used in the calculation of the **Ambient Occlusion**. This is off by default, as excluding the back faces makes the process faster and produces a very acceptable result, but may not be desired in all cases.

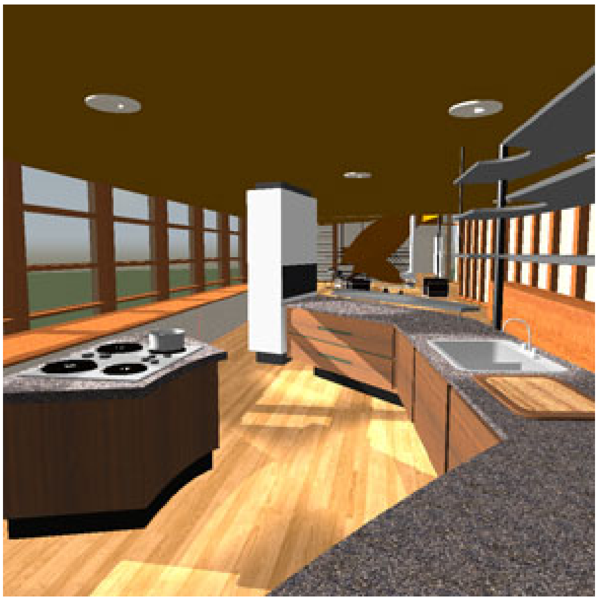
Examples of the advanced **Shaded Full** features in action are below.

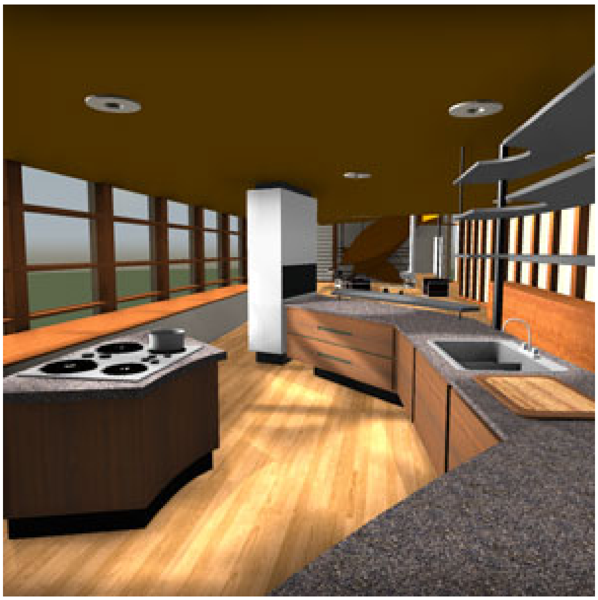


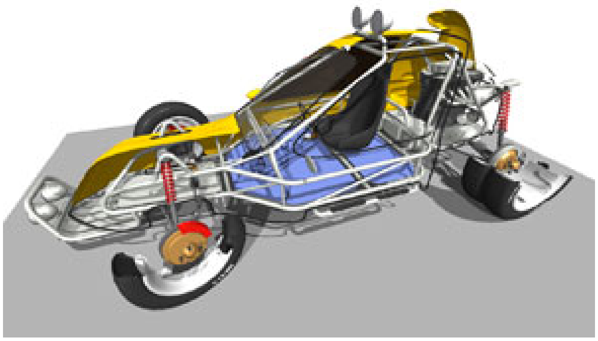
An interior model in the Shaded Full display mode.

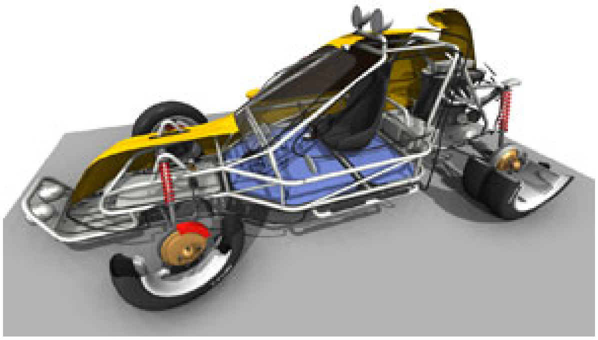


The model in the Shaded Full display mode in form•Z 8.0 displayed with Soft Shadows and Ambient Occlusion.


An interior model in the Shaded Full display mode.


The model in the Shaded Full display mode in form•Z displayed with Soft Shadows and Ambient Occlusion.


A model in the Shaded Full display mode.

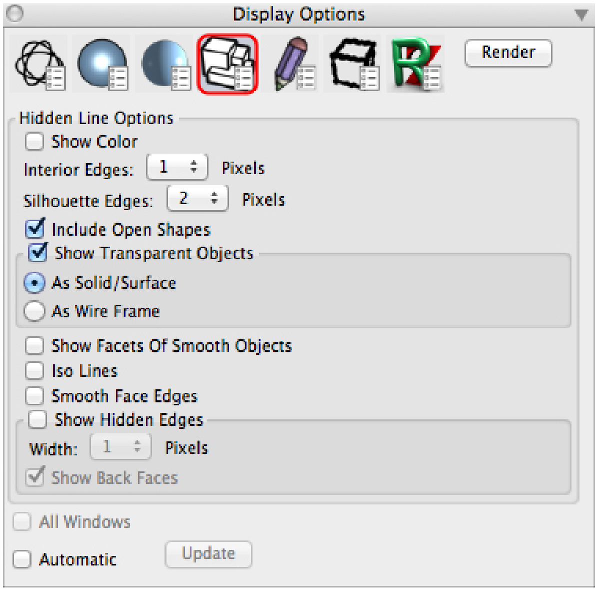

The model in the Shaded Full display mode in form•Z displayed with Soft Shadows, Ambient Occlusion, and Bumps.

Hidden Line

This display method generates a hidden line image in the active window. The hidden line elimination method produces displays where only the visible lines of a scene are shown. The hidden line method resolves the intersections of surfaces, eliminates all back facing surfaces, and displays only the portions of the visible edges that are not obscured by other visible surfaces. The removal of hidden lines is a computationally intensive process that makes the hidden line method substantially slower than wire frame. Its options are as follows:

Show Object Color: When selected, the colors assigned to an object are shown. When deselected, all lines are shown in black (default).

Interior Edges n Pixels and Silhouette Edges n Pixels: The line widths of interior and silhouette edges can be increased or decreased through these respective pop up menus.



Hidden Line Options

☐ Show Color

Interior Edges: 1 Pixels

Silhouette Edges: 2 Pixels

☑ Include Open Shapes

☑ Show Transparent Objects

● As Solid/Surface

○ As Wire Frame

☐ Show Facets Of Smooth Objects

☐ Iso Lines

☐ Smooth Face Edges

☐ Show Hidden Edges

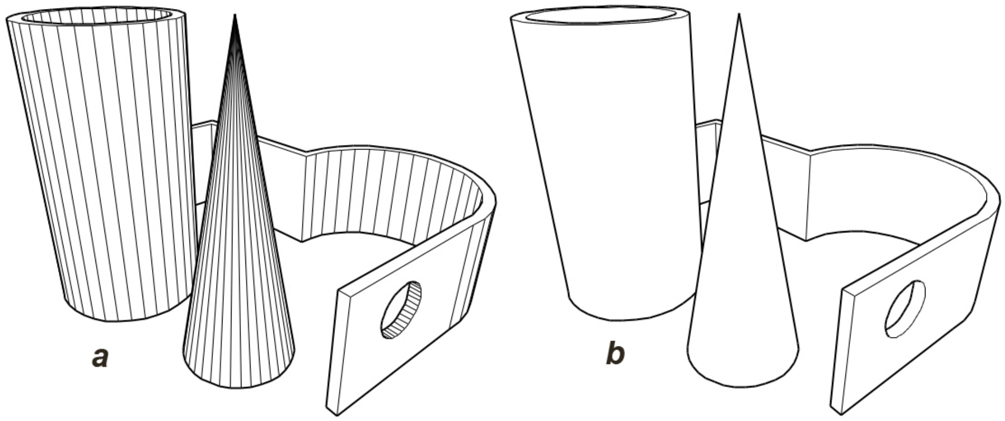
Width: 1 Pixels

☑ Show Back Faces

☐ All Windows

☐ Automatic

The Hidden Line Options Palette.



Hide Edges With Angle (a) off and (b) on.

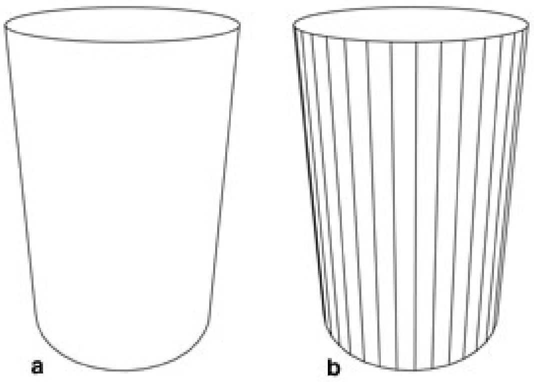
Include Open Shapes: When selected, the shapes that are open and do not define a surface are plotted. Such shapes cannot hide other solid objects, but may be (partially or completely) hidden by them. When deselected (the default), open shapes are skipped, and not plotted.

Show Transparent Objects: When this option is on, objects that have been assigned transparent materials will be displayed according to the following selection. When off, transparent objects are treated as invisible and are not displayed. A transparent material is one where the transparency parameter in the **Material Parameters** palette shows a value greater than zero.

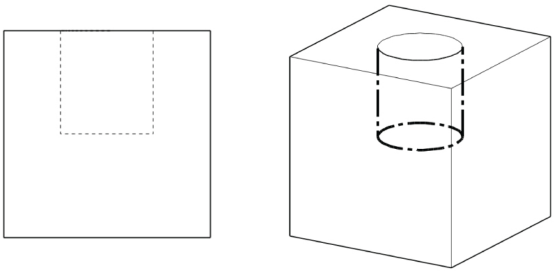
As Solid/Surface: When this option is selected, transparent objects are treated as common opaque objects and are displayed accordingly.

As Wire Frame: When this option is on, transparent objects are displayed as wire frames.

Show Facets Of Smooth Objects: When this option is selected, the respective rendering is



Show Facets Of Smooth Objects (a) off and (b) on.

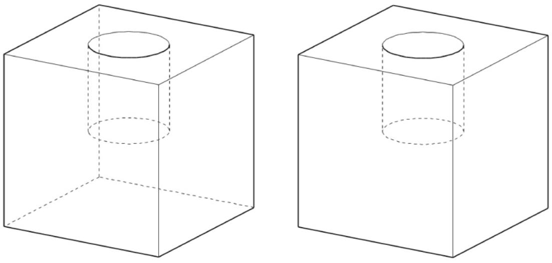


Show Hidden Edges: On

generated using the facets of the model rather than the edges of the smooth faces. This option is off by default.

Isolines: When this option is selected, the respective rendering is generated using the isolines of smooth objects and faces.

Smooth Face Edges: When this option is selected, the respective rendering is generated using the edges of smooth objects and faces.


Show Back Faces: On (left) Off (right)

Show Hidden Edges will display the **Hidden Edges** in a Hidden Line rendering.

> **Show Back Faces** is an option in the Show Hidden Edges parameters that allows previously unseen parts of geometry visible with this rendering option.

Save Image controls options for saving the **Hidden Line** image after it is rendered. You can specify saving **Manually**, in which you must save you image using the **Export Image** command from the **File Menu**. You can also specify that the image be saved **Automatically**, and set up the options for this using the Options button. You can also elect to use the **Default** behavior, which saves the image files into the Documents/formZ Folder/Hidden Line Images folder.

All Windows: As for **Wire Frame**.

Project level rendering options

The **Shaded Work** and **Shaded Full** options palettes include a button labeled **Project Rendering Options...**. This item is also available in the **Display** menu. The **Project Rendering Options** offers condensed rendering parameters, stored on a per project basis.

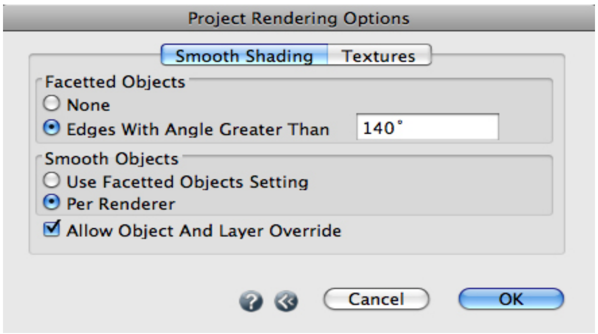
The **Project Rendering Options** dialog consists of two tabs as follows:

Smooth Shading tab

Facetted Objects: The options in this group determine whether or not facetted objects will be smooth shaded when rendered.

None: When this option is selected, facetted objects do not get smooth shaded.

Edges With Angle Greater Than: When this option is selected, facetted objects are smooth shaded, where the angle between two faces (across an edge) is larger than the angle entered in the text field.



Project Rendering Options

Smooth Shading | Textures

Facetted Objects

○ None

● Edges With Angle Greater Than 140°

Smooth Objects

○ Use Facetted Objects Setting

● Per Renderer

☑ Allow Object And Layer Override

The Project Rendering Options dialog with the Smooth Shading tab open.

Smooth Objects: The options in this group determine how smooth objects are treated when rendered.

Use Facetted Objects Setting: When this option is selected, smooth objects are rendered with the option selected for facetted objects (**None** or **Edges With Angle Greater Than**).

Per Renderer: This option allows each rendering type to render smooth objects as best as it can.

Allow Object And Layer Override: When this option is on, objects that have their own Smooth Shading attribute, will override the settings of the **Project Rendering Options**. The same is true, if a layer uses a Smooth Shading override attribute. If this option is off, only the **Project Rendering Options** apply. For example, if a scene needs to be rendered completely flat shaded, the **Facetted Objects** option should be set to None, the **Smooth Objects** option set to Use **Facetted Objects Setting** and the **Allow Object And Layer Override** should be turned off.

Textures tab

When an object is created it often has a natural texture map control (i.e. sphere, cylinder, etc.). For those that do not, the default texture map control is used.

> **Origin**: The values entered in the X, Y and Z fields represent the position of the origin of the texture coordinate system.
>
> **Rotation**: The values entered in the X, Y and Z fields are in degrees and represent the angles the texture coordinate system will be rotated relative to its axes. These rotations are always executed in Z, Y, X order.
>
> **Reset** : When this button is pressed, all three angles are reset to 0 degrees.

The fields in the **Wrapped Textures** section determine the mapping type and size of wrapped (2D) textures. Since a wrapped texture is two dimensional in nature, but is rendered on a three dimensional object, it must be projected (mapped) from 2D to 3D. This is done via a mapping type and a size specification.

Mapping Type: One of four basic mapping types can be selected from this menu: **Flat, Cubic, Cylindrical** and **Spherical**.

Flip: When this option is selected, the vertical and horizontal directions of the 2D texture are reversed.

Horizontal/Vertical Tiling Size: The size of the each dimension of the texture is specified in these fields. For **Flat** and **Cubic** mapping the size is expressed as a linear distance. For **Cylindrical** mapping, the horizontal direction is an angular value and the vertical size is linear. For **Spherical** mapping both values are angular.

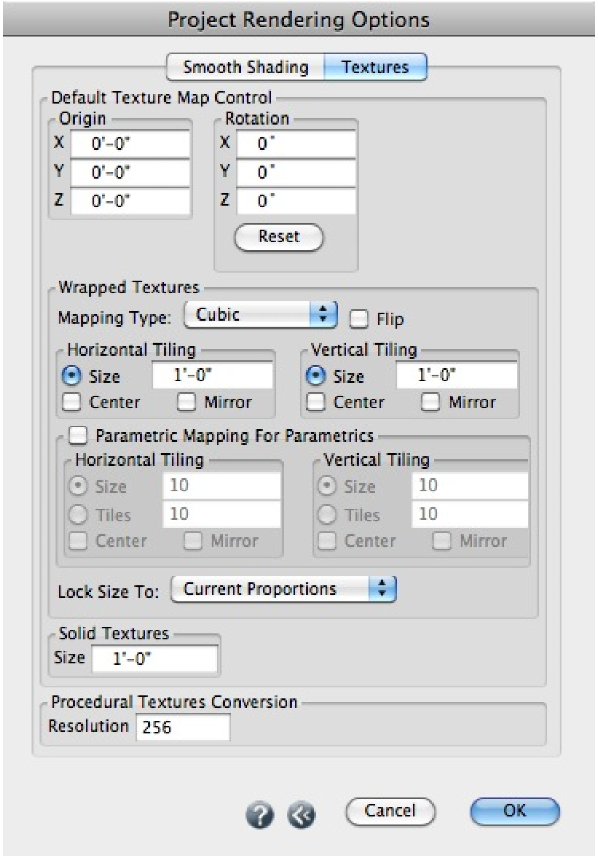
Center: When this option is selected, the texture tile is centered in the horizontal and/or vertical direction, relative to its origin. When off, the lower left point of the texture is placed on the origin of the texture coordinate system.

Mirror: With this option, the texture is mirrored in the horizontal and/or vertical direction.

Parametric Mapping For Parametrics: When this option is on and the object rendered is a parametric object, the **Parametric** mapping type with the Tiling parameters below this option are applied. Parametric objects which are affected by this option are : analytic primitives (cylinder, cone, sphere, torus), nurbs objects and c-meshes. When this option is off, the mapping type selected in the **Mapping Type** menu above is applied to a parametric object.

Lock Size To: When **None** is chosen from this menu, the Horizontal/Vertical tile sizes can be set independently. If **Square** is selected, typing a new value for the horizontal size automatically sets the vertical value to be the same, and vice versa. When **Current Proportions** is selected, the ratio of the horizontal to vertical size is maintained when entering a new value.

Solid Textures Size: The value entered in this field determines at what size solid (3D) textures are rendered.



Project Rendering Options

Smooth Shading | Textures

Default Texture Map Control

Origin: X 0'-0" Y 0'-0" Z 0'-0"

Rotation: X 0° Y 0° Z 0°

Wrapped Textures

Mapping Type: Cubic ☐ Flip

Horizontal Tiling: ● Size 1'-0" ☐ Center ☐ Mirror

Vertical Tiling: ● Size 1'-0" ☐ Center ☐ Mirror

☐ Parametric Mapping For Parametrics

Horizontal Tiling: ● Size 10 ○ Tiles 10 ☐ Center ☐ Mirror

Vertical Tiling: ● Size 10 ○ Tiles 10 ☐ Center ☐ Mirror

Lock Size To: Current Proportions

Solid Textures: Size 1'-0"

Procedural Textures Conversion: Resolution 256

The Project Rendering Options dialog with the Textures tab open.

)

Drawing Objects

There are a number of tools in **form•Z** that create objects through interactive drawing in the project window. These tools are found in the **Draw** and the **Create** suites of tools. While both suites create objects through graphic interaction, they work a bit differently. We discuss the **Draw** suite here and the **Create** suite in another section.

The **Draw** tools create objects by graphically (or numerically) drawing a base shape. From this base shape a variety of object types can be generated, which depends on the object type selected from the **Draw** tool palette. The shapes drawn can produce independent new objects or they can be used to modify existing objects.

Each **Draw** tool offers different drawing methods.

Rectangle,

Polygon,

Circle

:

All these tools create exclusively closed shapes that are drawn on a single plane. They require a fixed number of clicks to complete the shape.

Vector Line,

, Spline,

and Arc.

These tools are used to draw either open or closed shapes. With them you draw continuously until a shape is closed or terminated as an open shape. You can close a shape in three different ways: by returning and drawing to the first point, by pressing the character "c" on the keyboard, or by triple-clicking. You can terminate an open shape in two ways: by pressing "e" or by double clicking.

The open shape drawing tools are compatible with each other and they can be changed as you draw. For example, you can start drawing with the **Vector Line** tool, then switch to the **Arc** tool, then to a **Spline** tool, etc. The resulting shape is a composite type. These shapes can also be drawn on different 3D locations (not positioned on the same plane), which makes it possible to create non-planar shapes.

All the **Draw** tools create shapes by clicking in the project window. The drawing is relative to the active reference plane, as discussed in the previous section, or relative to an object part to which the cursor may be snapped. Snapping is discussed in a previous section.

When working in a shaded view (**Shaded Work** or **Shaded Full** items in the **Display** menu), drawing can be performed on the visible faces of existing objects. When the cursor is positioned on a face of an object, a temporary reference plane, called a **face reference plane**, is automatically defined from the face of the object. A grid is displayed on the face plane and all drawing occurs on the face reference plane. What is drawn on a face reference plane may become an independent shape or may be inserted to the face.

Options of the Draw tools

The tool options for all of the **Draw** tools share a common object type section. This contains six icons representing six types:

2D: When this type is selected, the shape remains as it was drawn. That is, the base shape is the final object. If the shape is closed and planar, then a surface object is created. If the shape is non-planar or has open ends, then a wire object is created.

2D Wall: When this type is selected, a double line is created from the base shape. 2D walls are always surface objects. The wall justification and width are set in the tool options palette.

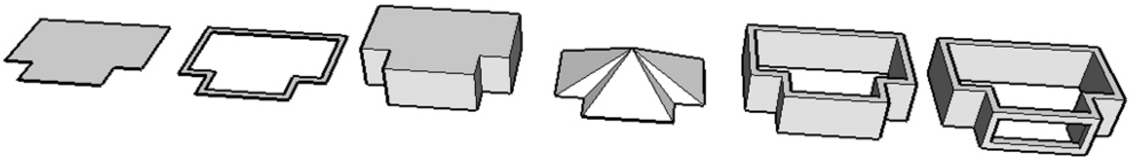
3D Extrusion: When this type is selected, the base shape is extruded perpendicular to the base shape to form a 3D solid object. Once the base shape is drawn, the height of the extrusion is interactively defined. It follows the motion of the mouse until one more click sets the height and completes the extrusion.

3D Extrusion to Point: This type works as the 3D extrusion except that the extrusion converges to a point rather than being in a parallel direction.

3D Wall: This type first creates a 2D wall, which it then extrudes, producing a 3D wall.

Opening: This type always affects an existing object as opposed to generating an independent entity. For this type drawing must be done on a face of an existing object.

Examples of all six types are shown below:



2D shape 2D wall 2D extrusion extrusion to point 3D wall opening

The types of objects that can be generated.

The **Insert** option in the tool options palette for the Draw tools determines whether an existing object will be modified. When it is on and the drawing occurs on a face of an existing object, the drawn shape is inserted into the original object. When this option is off, a new object is created. If the drawing does not start on a face of an existing object, the **Insert** option is ignored and a new object is created. The cursor shows if an insertion will occur or not. It displays a plus sign (⊕) when the insert option is on and the cursor is positioned on a face.

Examples of insertions are shown below:

(a) The original object.

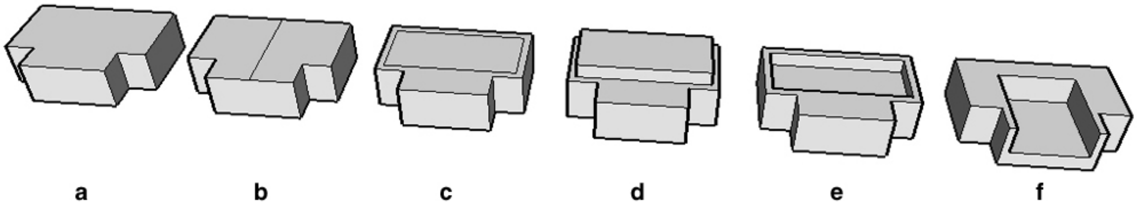
(b) With the **2D** type on, a single line is drawn and inserted.

(c) With **2D** on again, a rectangle is drawn and inserted.

(d) With **3D Extrusion** on, the same rectangle is drawn first and then a height is defined with an additional mouse click.

(e) Everything is as in (d) except that the height is now set in a negative direction and the extruded volume is subtracted rather than being added to the original object.

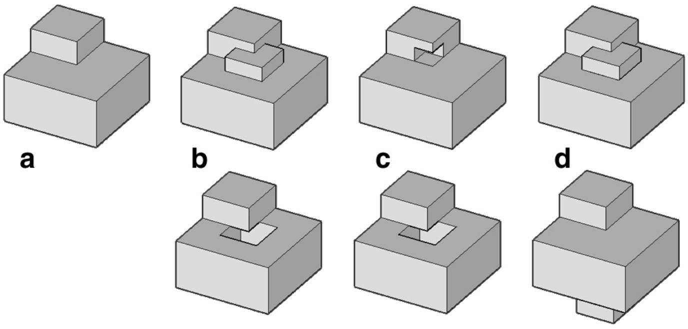
(f) With **3D Extrusion** on, a rectangle that extends beyond the bounds of the face is drawn and then a negative height is defined. In this example a rectangle can either be drawn on the top face or the front face, both producing the same result.



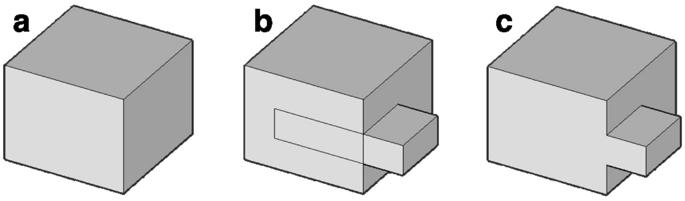
Examples of insertions.

As illustrated above, the insertion works in conjunction with the object type. That is, inserting with the **2D** type on inserts the new shape into the original face, while inserting with the **3D Extrusion** type adds or removes material from the original object. The **3D Extrusion, 3D Extrusion to Point** and **3D Wall** types all add or remove material from an object. For these types their tool options palettes contain a few options that control if material is added or removed, and whether edges and material assignments are kept.

Insert menu: This is active when **Insert** is on.



How insertions are affected by insertion options: (a) Original object. Volume is drawn with height (top:) up and (bottom:) down. Using (b) Cut and Fill, (c) Cut, and (d) Fill.



The Keep Edges option:(a) Original object. Option is (b) on and (c) off

Cut and Fill: If the 3D object is drawn upward (away from) the base face, material is added to the object. If the object is drawn downward (into) the base face, material is removed (cut out).

Cut: This method always removes (cuts) material from the object regardless of the direction from the base face.

Fill: This method always adds material to the object regardless of the direction from the base face.

Keep Edges: This option affects what happens to edges of faces that are co-planar with the inserted geometry. By default these edges are removed. This option can be enabled to keep these edges as they may be useful for further modeling steps.

Keep Material: This option determines the material that is applied to the newly created faces. When this option is on, the material of the face being inserted into is used. When this option is off, the active material is used. This option is on by default.

Height: This field may perform two different tasks. When **Dynamic** is off, the height of a 3D object is preset and takes the value in this field. When **Dynamic** is on and the height is entered interactively, after it is entered its value is displayed in this field. When preset height is used, a value for the height can also be picked from the pop-up menu next to **Height**.

Source Object: These parameter fields appear in the tool options palette as soon as the drawing of an object has been completed. They represent the dimensions of the base shape and they can be used to change them while the object is in edit mode.

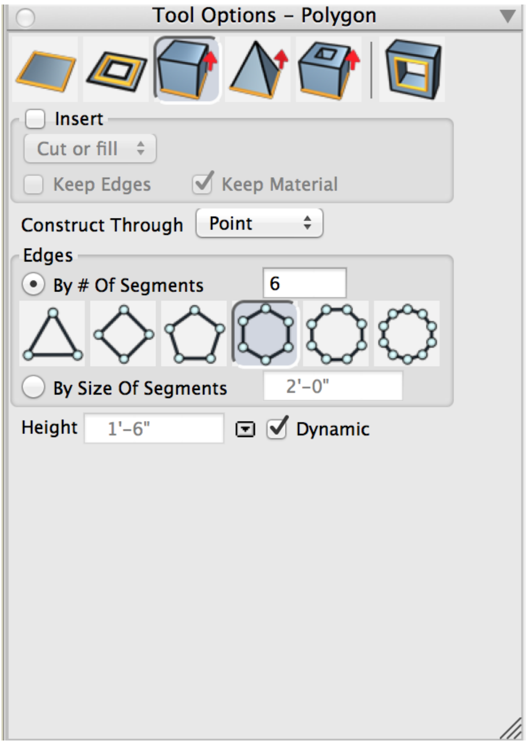
Options of the Polygon tool

At the top of the **Polygon** tool options palette are the options common to all the drawing tools. They are followed by more options unique to polygons.

The **Polygon Drawing** popup menu contains three items that affect how the polygon is drawn: **With Center & Radius** (default) the first point defines the center and the second the size of its radius. **With Diameter** both points are on the polygon’s circumference. X, Y. Dimensions is as **Diameter** except that the X,Y of the second point are interpreted independently. The **Construct Though** popup menu contains two items: Point places a point at the second click. Segment places a segment.

The **Edges** group offers two methods for setting the resolution of a polygon: **By #** and **By Size Of Segments**. For **By #**, you can type the number of segments in its field or pick one of the icons. For By

Size you type the desired segment size in its field. Note that the ultimate size of the segments will depend on the size of the polygon.



Tool Options – Polygon

☐ Insert

Cut or fill

☐ Keep Edges ☑ Keep Material

Construct Through: Point

Edges

● By # Of Segments: 6

○ By Size Of Segments: 2'–0"

Height: 1'–6" ☑ Dynamic

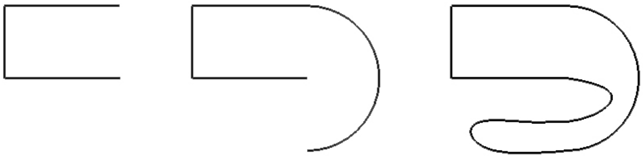
The Polygon Tool Options palette.

Appending to open wires

When using the 2D method ***with*** any of the continuous drawing tools the insert option can be used to append new shapes to existing open wire objects. When the cursor is positioned at the end of an existing open wire object, the cursor includes a plus sign to indicate that the new shape will be appended to the existing shape. See illustration.

Modifying results

When a drawing operation results in a new object (i.e. no insertion occurred), the result object is shown in orange and graphic controls become visible. This indicates that its parameters can be modified. The on screen controls can be graphically edited at this point to change the shape. Many settings in the tool options can also be changed at this time. Clicking away from the controls will start the drawing for the next object and the recently drawn object will no longer appear in orange and the controls will disappear.



(a) A vector line is first drawn. (b) Starting at an end point of the vector line, an arc is drawn, which connects. (c) Again, starting at an end point of the previous shape a spline is drawn, which also ends at the other end point of the previous shape. At the end, all three lines have been connected to one closed shape

Picking

There are two pick tools in **form•Z**:

Pick.

These tools allow you to select objects, object parts, lights, guides, and other graphic entities in a project window. Picking serves two main purposes: (1) Selecting one or more entities so that an operation may be applied to them. (2) Selecting an entity so that its attributes and parameters may be shown and edited.

Prepicking and postpicking

In **form•Z**, entities can be picked with one of the pick tools or directly with one of the other tools that apply operations to entities. When a pick tool is used to pick one or more entities and then another modeling tool is activated and applied to the picked entities is called the **prepick** method. When a modeling tool is used directly to both pick an entity and apply an operation is called the **postpick** method. Which method is preferable depends on the circumstances.

For a prepick example, with the **Pick** tool select one or more objects. Then activate the **Move** tool and click once to start moving and one more time to end moving. Notice that, after ending the move, the objects remain highlighted. Alternatively, the postpick method can be used. Activate the **Move** tool directly and with it click on an object to start the move. Then click again at another location in the project window to end the move. Notice that, in this case, the object is not highlighted after the operation is completed. We discuss a bit later how to postpick more than one object.

Previewing the picks

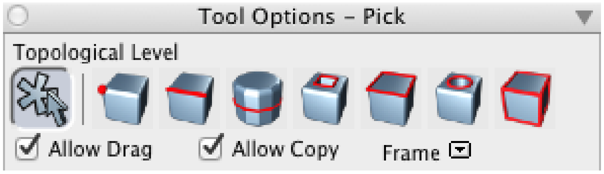
When **form•Z** expects a pick, moving the cursor over an entity will draw the entity in a dimmed version of the highlight color (by default pale red). This will give you a preview of what would be picked if you were to click at this point. This is referred to as **preview picking**. Once clicked, the picked entity is drawn in the full highlight color. When moving the cursor over an already picked entity, the pale preview highlight is drawn as a dashed line on top of the full highlight. There is an option for toggling this feature on/off under the **Edit** menu, called **Selection Preview**.

Pick previews can be done with all pick tools and the other modeling tools. While the pick tools will preview all the pickable entities, each modeling tool is programmed to pick preview only the entities that are acceptable to its particular operation. For example, a roof is only generated from a closed, flat face of an object and cannot be generated from a complete solid. When previewing picks with the **Roof** tool, it will only highlight the flat faces of objects.

When activating a tool with one or more entities prepicked and some of these entities are not suitable for the operation, the offending entities are automatically removed from the picked set. For example, the **Reshape** tool only works on planar faces. If you prepick two planar and two spherical faces with the Pick tool and you then activate the **Reshape** tool, the spherical faces will be unpicked.

Picking complete versus parts of object

form•Z allows you to pick entire objects or parts of objects and is affected by the **Topological Level** icons found in its **Tool Options** palette. The first icon on the far left is **Auto Pick**.



☑ Allow Drag ☑ Allow Copy

The Pick Tool Options palette.

When the **Pick** tool and the **Auto Pick** topological level are active, moving the cursor over an object highlights the entire object and clicking at that point will select the entire object. To select a face, curve, segment, or point of an object you need to move the cursor over the object part you want to pick and press the ***command*** key (Macintosh) or ***ctrl*** key (Windows). This will change the preview pick from the object to the object part you are pointing to. For example, if the cursor is directly over a segment, that segment will be picked and highlighted. If the cursor is over a face, not close to a segment, the face will be highlighted, etc. Clicking with the ***command/ctrl*** key down will pick the highlighted object part.

The seven icons to the right of **Auto Pick** correspond to **Point, Segment, Segment Sequence, Outline, Face, Hole**, and **Object**. Selecting one of these icons tells **form•Z** exactly what to pick when you place the cursor and click over a respective entity.

It generally takes one click to pick an entity at any topological level. However, faces, outlines and holes can also be optionally picked with two edge clicks. This is controlled by the **2 Click Face/Outline Selection** in the **Edit** menu, which is, by default, off for **Shaded** rendering and on for **Wire Frame**. The 2-click method picks faces with both the **Auto Pick** and **Face** topological levels. For outlines and holes it only works with the **Outline** and **Hole** topological levels, respectively.

Selecting one of these icons tells **form•Z** exactly what to pick and so it does when you place the cursor and click over a respective entity.

Moving and copying with the Pick tool

The **Pick Tool Options** palette contains two options that allow you to execute a move and a copy operations with the **Pick** tool.

Allow Drag: when on, you can click and drag an entity (complete object or part) to move it to another location, without resorting to the **Move** tool.

Allow Copy: When on and you click and drag an entity while pressing the ***option*** (Macintosh) or ***alt*** (Windows) key, a copy is dragged and placed at the final position of the mouse.

Pick parade

Frequently, a part of an object may belong to more than one topological level. For example, a hole is also part of a face, which in turn belongs to a complete object. Thus placing the cursor on a point and clicking on it could potentially pick any of the above entities and the program has no way of knowing what is the intention of the user. In such cases the ability to parade through all the choices while previewing the possible picks is available. When the desired entity is highlighted, clicking selects that entity.

To parade through all the possible picks, place the cursor over the object part, then hit and release the **tab** key. The next best object part will be highlighted. Hitting the **tab** key repeatedly will cycle through all the choices available. When you see the entity you want to pick, clicking will select it.

Picking multiple entities

By default, clicking on an entity (with or without the **command/ ctrl** key pressed) that is not picked, selects just that entity. Other entities, that may have been picked will be deselected. If an entity is already picked and you click on it again, nothing will happen.

If you want to pick more than one entity, hold the ***shift*** key down, and click on additional entities that are not already picked. Clicking on an already picked entity, while pressing the ***shift*** key, deselects that entity. Whether an object will be added or removed is indicated with a "-" or "+" sign next to the cursor while the ***shift*** key is pressed.

Whether the ***shift*** key is required or not for multi-picking is controlled by the **Use Shift Key For Multiple Pick** option in the **Project : Modeling : General** tab of the **Preferences** dialog that can be invoked from the **form•Z** menu (Windows) or the **Edit** menu (Macintosh). This option is on by default. If turned off, you will be able to multi-pick without having to press **shift**.

Picking sets

Many tools can only be applied to single objects. In these cases, using the postpick method, with the tool active, you just click on an object. Many other operations require more than one operands and frequently the number of operands may vary. For example, the loft operation, can generate a lofted object from a minimum of two shapes or it can generate an object from a larger number of shapes. Each tool knows what is the minimum number of objects it requires. When the minimum number is used, the operands can be picked directly. When more than the minimum number are used, they have to be picked as ***sets***. Following is how you pick a set:

- Activate the tool you wish to apply.
- With the ***shift*** key pressed, pick objects. The cursor will show the "⊕" sign next to it. This picks objects for set one.
- After the last object of the set is picked, release the ***shift*** key, move the cursor away from any pickable object, and click. After ***shift*** is released, the cursor shows a red star indicating that the next click will finish the set.

You have just completed picking a set. If the tool needs another object to be picked, if you intend to use the minimum number required, you just click on the object(s). If you intend to use more than the minimum requirement, you have to pick another set, as you did above.

If a tool is activated with one or more objects already picked, they are considered to comprise set one. No more objects can be added to set one, using postpick. Postpicking will proceed for the selection of the objects in set two, as before. That is, with ***shift*** pressed, click on the objects of set two, then release ***shift*** and click away from any pickable object. The operation will be executed as soon as you click.

Another example of an operation that is often used with just two operands and is often also used with multiple operands is the **Boolean Difference**. When applied to just two objects, they are picked directly and there is no need to pick sets of objects using ***shift***. In contrast, when a number of objects have to be subtracted from a number of other objects simultaneously, these two groups of objects have to be picked as sets, using the ***shift*** key.

Area picking

The **Pick** tool can also be used to execute area picking, more specifically called ***frame*** picking, as it always uses a rectangle to pick. To frame pick, you click on an empty area of the screen and drag. Which entities are picked depends on the selection from the **Frame** popup menu.

Off disables the frame picking. **Inside Only** pick only the entities that are completely contained in the rectangular frame. **Crossing Left-Right** picks all the entities that are contained and also the entities the frame crosses when it is drawn from left to right. **Crossing Right-Left** is exactly the opposite for crossing entities. **Crossing Always** picks all the entities it contains and it crosses regardless of the direction in which it is drawn.

The drawing of the picking frame can also start by clicking on a non-empty area of the screen, if the ***shift*** key is pressed.

Changing attributes and parameters with the Pick tool

The attributes and parameters of the picked entities are displayed in the **Tool Options** palette, which consists of up to four tabs, as follows:

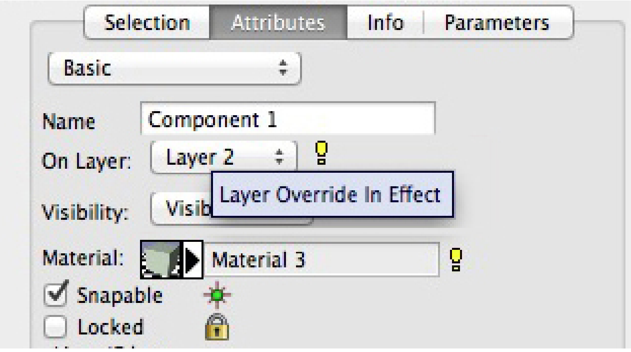
Selection tab: This tab contains information about how many entities are currently selected.

Attributes tab: If one or more objects or faces are selected, this tab shows the value of the object or face attributes. For example, it shows whether an object casts shadows or not in the check box **Casts Shadows.** Clicking in the check box turns the attribute on or off for all selected objects. If some of the objects selected had this attribute set to on and others off, the check box shows a "-" indicating that the attribute varies among the selected entities. The same principle applies to all attribute values shown in this tab. The tab is further organized in attribute categories, which can be selected from the menu at the top of the tab.

Another example would be **Show Face Normals**. The normals are vectors perpendicular to a surface. When this option is on, the normal vectors of all faces are also displayed. This option is off by default. Note that, when objects have dense faces, the normals may be hard to read. In such cases displaying the objects with their back faces eliminated improves their readability. Another method for improving the readability of the normal vectors is to select individual faces. When faces are selected, their normals are also highlighted, which makes it easier to see which normal corresponds to the selected face.

Component instances have there own override attributes. That is when an attribute like the material or shadow casting of a component is changed, it is applied to the placed instance and there is no prompt to update the component definition. This is works for all of the basic object attributes.

Overridden attributes can be cleared when a component is selected with the **Restore Original Attributes** button in the **Parameters** tab of the **Tool Options – Pick palette**.



Basic

Name: Component 1

On Layer: Layer 2

Layer Override In Effect

Visibility: Visib

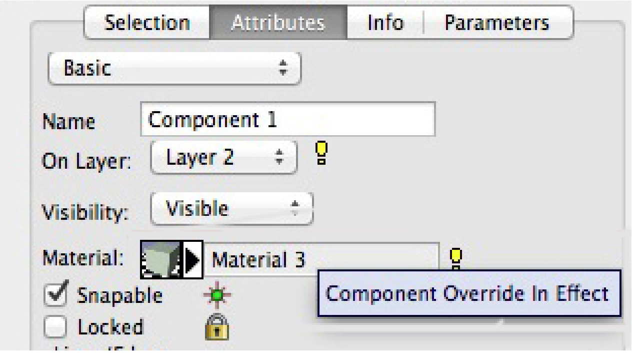
Material: Material 3

☑ Snapable

☐ Locked

The Layer Override in Effect.

Examples of Component overrides are shown on the right. A yellow exclamation point is displayed to the right of the attribute that it has been overridden. This means that the original **Component** definition has not been updated, and placing new instances of the component will place them without the overrides. This allows a single component to display differently as various instances, and any changes to geometry in the original **Component** file can be propogated to the instances without disturbing **Component** overrrides.



Name: Component 1
On Layer: Layer 2
Visibility: Visible
Material: Material 3
☑ Snapable
☐ Locked

The Component Override in Effect.

Info(rmation) tab: This tab contains more information about the selected objects or faces, such as the object type, the origin, and rotation of the object. If more than one object is selected, the information is cumulative.

Parameters tab: If only one object is picked and the object is a controlled object, its parameter values are shown in this tab. Changing a value will automatically update the object. If entities other than objects are picked, this tab will not be shown.

When multiple objects of the same type are selected and no objects of any other type are selected, the parameters of the objects are displayed and can be edited. When a parameter is the same among the selected objects, then that value is shown in the normal fashion. When a parameter is changed, it is applied to all of the selected entities.

If a parameter is different between any two objects, then it is displayed differently to indicate that there are multiple values present. Text field parameters (usually numbers) are displayed as **"[multiple]"**. Check boxes and radio button type parameters are shown with a dash through them.

For example: When two cubes of the same height but different length and width are selected, the length and width appear as "[multiple]". The height displayed is the height of the two objects as they are the same. Changing the value in the length and width parameters will yield two cubes with the same dimensions.

A **Parameters** tab is also available when NURBS curves or surfaces are selected with the **Pick** tool. The tab displays the NURBS degree, the number of control points, and the closure status. Entering a higher number in the degree field can raise the degree of the curve. This is standard degree elevation without reconstruction. For the surfaces, the NURBS degrees, the number of control points, and the closure status are displayed for both the U and V directions. Entering a higher number in the corresponding degree field can raise the U or V degree of the surface. This again is standard degree elevation without reconstruction.

Modifying objects while they are generated or edited

Most modeling tools offer the user parameters in the **Tool Options** palette that guide the generation or editing of objects. After such a tool is executed, the new or edited objects are drawn in an orange highlight color. This indicates that the parameters in the **Tool Options** palette still affect the object. If the user types a new value for one of the parameters, the highlighted objects are regenerated with the new parameter.

For example, activate the **Revolve** tool and pick a source shape and an axis of revolution. The operation is executed using the current parameters in the **Tool Options** palette. The new object is now shown in the orange highlight color. If you now type a new value for the **Angle Of Revolution** parameter, the object is rebuilt immediately to reflect the new angle.

In addition, if the tool creates a parametric object, the object controls are shown right away (see **On Screen Controls**). The user may graphically edit the object parameters using the on screen controls. Note, however, that controls are only shown when the tool creates a single new object. For example, if you pick several 2D shapes with the **Pick** tool and you then activate the **Extrusion** tool and you generate ten new objects, they are all shown in the highlight color and they can be further numerically edited, but no controls are shown.

Objects that were just created or edited and are drawn in the orange highlight color may also be deleted by pressing the **delete** key.

If the tool is deactivated or executed again, the controls of the object are removed and it is no longer drawn in the highlight color. You may also clear the orange highlights any time by clicking on the **Deselect** command in the **Edit** menu, by pressing **option + tab** (Macintosh) or **ctrl + tab** (Windows), or by hitting the esc key.

On screen controls

form•Z makes extensive use of on screen controls to modify objects, textures and other entities.

Many objects, such as spheres, cubes, and extruded shapes maintain their generation parameters. They are called **controlled objects**. Their control parameters may be shown on the screen through simple graphic controls, which allow the user to edit the shape of the object. For example, an extruded object shows an arrow for the extrusion height. Clicking in the arrow tip interactively changes the height of the extrusion by dragging the cursor along the arrow direction.

Object controls are shown right away when the object is created. For example, drawing a sphere shows its controls after the interactive generation is completed. The user may now refine the shape by using the on screen controls. Leaving the generation tool, turns the controls off.

Object controls may be turned on and off with the **Pick**, **Pick Part**, or **Area Pick** tools. For example, after a sphere was drawn, activate the **Pick** tool. This will remove the sphere's controls. Now pick the sphere and click on the **Show Controls** button at the bottom of the **Tool Options** palette. This will turn the controls on for all selected objects. The controls will stay enabled until they are specifically turned off again by clicking on the **Hide Controls** button.

Most tools have no use for object controls. For example, after turning object controls on with the **Pick** tool, you switch to the **Boolean Union** tool, the controls will be hidden, as they have no meaning for this tool. Switching back to the **Pick** tool will show the controls again.

There are two types of controls: **free moveable point controls** and **constrained controls**, such as **arrows**. These are manipulated in different ways.

Constrained controls

After the object controls are enabled with the **Pick** tool, the user may click in the "hot spot" of the control. This is indicated by the editable part of the control turning to the highlight color (red), when the cursor rolls over the part. For example, the extrusion height control consists of an arrow, starting from a base point, along a line, with a tip at the end. The tip is the hot spot. Clicking in the hot spot starts the interactive editing. In this case the tip is moved along the arrow direction, defining a new height. Clicking a second time ends the interactive editing. This method allows for only one such control to be edited at a time.

Picking such a control also automatically selects the object to which it belongs and the object's parameters are shown in the **Parameters** tab of the **Tool Options** palette. While the control is manipulated, the corresponding parameter in the palette is highlighted and its value is updated. For example, the height value of an extruded object is updated in the **Parameters** tab, as the height is changed through the control. Typing a value while the control is edited and hitting the **tab** or **return** key will end the control editing and use the typed value instead. This allows for a combination of graphic and numeric editing without having to move the mouse into a specific text field to activate it.

Free moveable point controls

As the constraint controls, these have a hot spot, which highlights when the mouse is moved over it. Clicking on it starts moving the point parallel to the current reference plane. Hitting and releasing the **command** key (Mac) or **ctrl** key (Windows) switches the direction to / from the perpendicular direction of the reference plane. A second click ends moving the point, which remains selected. Unlike constraint controls, multiple controls can be picked by holding down the **shift** key. This is the same method as picking multiple objects, except that **shift** needs to be pressed even for the first of several points that will be picked. Free moveable points are used primarily as the controls of spline curves and surfaces and end points of lines and arcs.

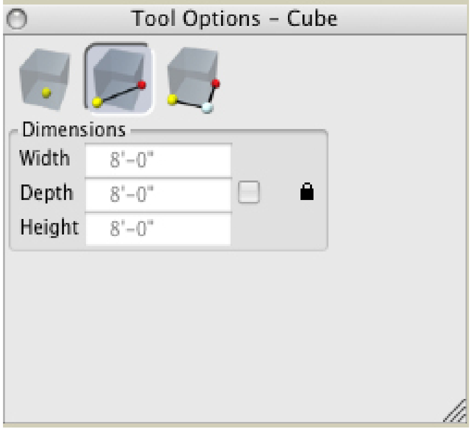
Free moveable point controls can also be modified with the **Move**, **Rotate**, **Scale**, and **Mirror** transformation tools, as well as the **Delete** tool. For example, you may pick several control points of a spline curve with the **Pick** tool. Then switch to the **Move** tool. You notice that the controls are still shown. Now move the controls by clicking a start and end point.

As with picking objects, if there are multiple controls on top of each other, they can be toggled by placing the cursor over the controls and then hitting the **tab** key. With each key stroke, the next control is highlighted. After the desired control is reached, the mouse is clicked to select the control.

A **Perpendicular to Surface** guide is available when editing control points of NURBS surfaces. When clicking a control point to move it, a snap guide is shown that is perpendicular to the surface, through the control point. This allows the control point to be easily moved closer to, or further from, the surface. This guide is also available when moving NURBS control points with the **Pick** tool.

Cube

This tool generates a cube using one of three methods that is selected from its tool options palette.



Tool Options – Cube

Dimensions

Width 8'-0"

Depth 8'-0"

Height 8'-0"

The Cube tool options palette.

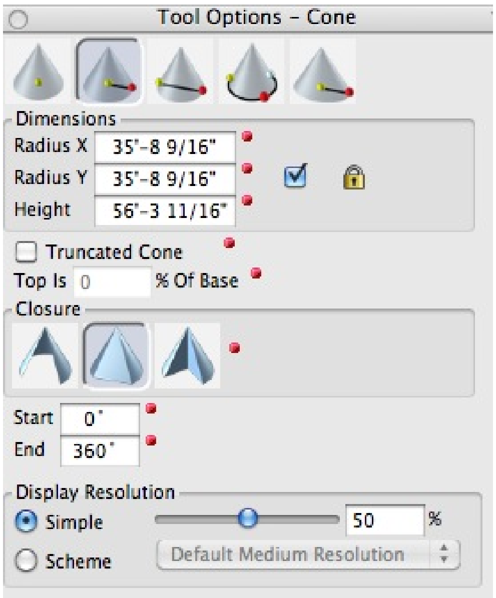
Preset: With this method, one click generates a cube at the click location. Its dimensions are determined by the values in the **Width**, **Depth**, and **Height** fields of its tool palette.

Diagonal: This method (default) requires two clicks to draw a rectangle and one more click to specify the cube's height.

Axial: This method requires four clicks. The first and second clicks draw one side of the base of the cube and the third complete the base rectangle. The fourth specifies its height.

Cone

This tool generates a cone using one of five methods.



Tool Options – Cone

Dimensions

Radius X 35'-8 9/16"

Radius Y 35'-8 9/16"

Height 56'-3 11/16"

☐ Truncated Cone

Top Is 0 % Of Base

Closure

Start 0°

End 360°

Display Resolution

● Simple 50 %

○ Scheme Default Medium Resolution

The Cone tool options palette.

Preset: With this method, a cone is generated with one click. Its dimensions are determined by the values in the **Radius X**, **Radius Y**, and **Height** fields of its tool palette.

Radius: This method (default) requires two clicks to draw the radius of a circle and one more click to specify the cone's height.

Diagonal: This method again requires two clicks to draw the diagonal of a circle. A third click specifies its height.

3 Points: This method requires three clicks to specify three points of a circle and a fourth click to specify the cone's height.

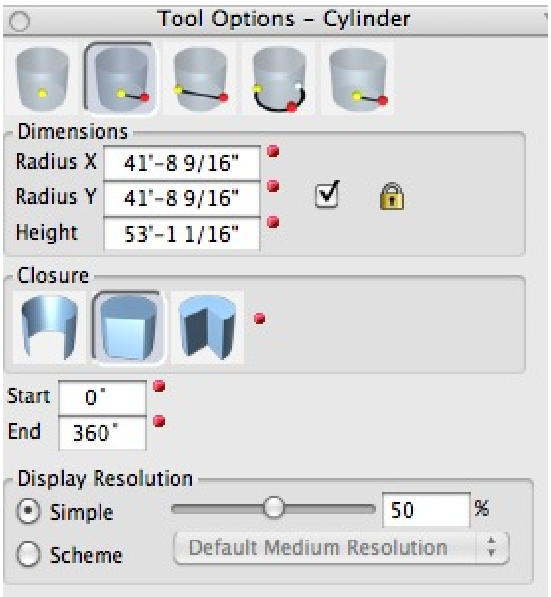
Ellipse: This method uses four clicks. The first click determines a center, the second one of the axes of an ellipse, the third the other axis of the ellipse, and the fourth the height of a cone with an elliptic base.

When **Truncated Cone** is on, after the basis of the cone is drawn, a cylinder is rubber banded when defining the height, and one more click is required to specify the size of the top face. This size is also reflected in the **Top Is** field of the tool options palette, where it is expressed as a percentage of the size of the base. This value can also be entered numerically, when the cone is still in edit mode.

After the initial generation of the cone is complete, the **Closure** options appear in the tool options palette. The cone can be partial rather than a complete revolution of 360°. This can be done by manipulating the controls that appear while it is in edit mode or by typing values in the **Start** and **End** fields. If the cone is partial, then the **Closure** icons determine what type of an object is generated. The first icon ( ) generates a surface object, the second ( ) and third ( ) generate two variations of solids. The former connects the two open edges. The latter connects each open edge to the axis of the cone. The second option is the default.

Cylinder

This tool generates a cylinder using one of five methods, which are identical to those for the cone. In general all the options in the **Cylinder** tool options palette are similar to those for the cone, except that there are no provisions for a truncated object, which is unique to the cone.



Tool Options – Cylinder

Dimensions

Radius X 41'-8 9/16"

Radius Y 41'-8 9/16" ☑

Height 53'-1 1/16"

Closure

Start 0˚

End 360˚

Display Resolution

● Simple 50 %

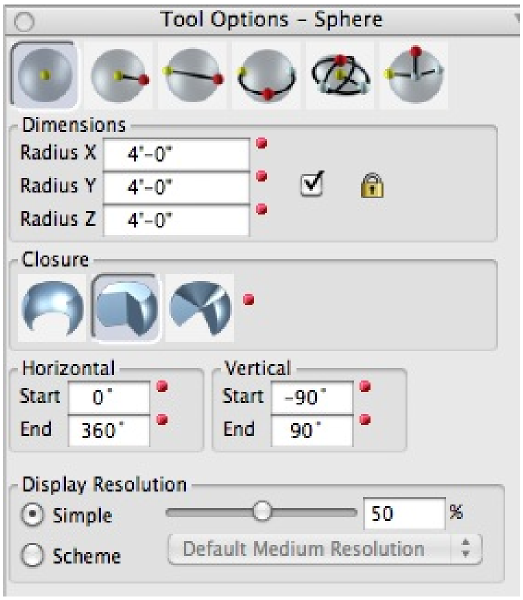
○ Scheme Default Medium Resolution

The Cylinder tool options palette.

Sphere

This tool generates spheres and its options are quite similar to those for the cone and cylinder. The first four drawing methods do not require a height specification. The fifth (**Ellipse**) does. There is also a sixth method called **4 Points**, with which a sphere is defined from four points.

Partial spheres can also be generated and they can be partial in either the **Horizontal** or the **Vertical** dimension, or both.



Tool Options - Sphere

Dimensions
Radius X 4'-0"
Radius Y 4'-0"
Radius Z 4'-0"
☑

Closure

Horizontal
Start 0°
End 360°

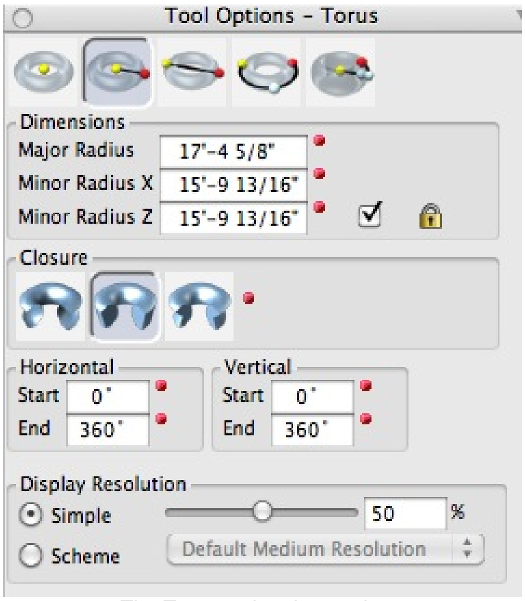
Vertical
Start -90°
End 90°

Display Resolution
● Simple 50 %
○ Scheme Default Medium Resolution

The Sphere tool options palette

Torus

This tool generates toruses and its options are again similar to those for the cone and cylinder. The difference is that, instead for specifying a height, for the torus you specify the radius of the small circle. Partial toruses can also be generated and they can be partial in either the **Horizontal** or the **Vertical** dimension, or both.



Tool Options - Torus

Dimensions

Major Radius 17'-4 5/8"

Minor Radius X 15'-9 13/16"

Minor Radius Z 15'-9 13/16" ☑

Closure

Horizontal

Start 0˚

End 360˚

Vertical

Start 0˚

End 360˚

Display Resolution

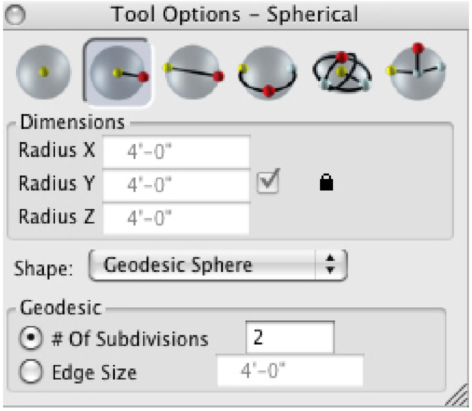
● Simple 50 %

○ Scheme Default Medium Resolution

The Torus tool options palette

Spherical Object

This tool generates the set of Platonic solids (tetrahedron, hexahedron, octahedron, dodecahedron, icosahedron), soccer balls, geodesic spheres, and revolved spheres. These are all facetted objects and are generated using exactly the same drawing methods as the **Sphere**. The type of spherical object to be generated is selected from the **Shape** pop up menu. See the examples of the different types.



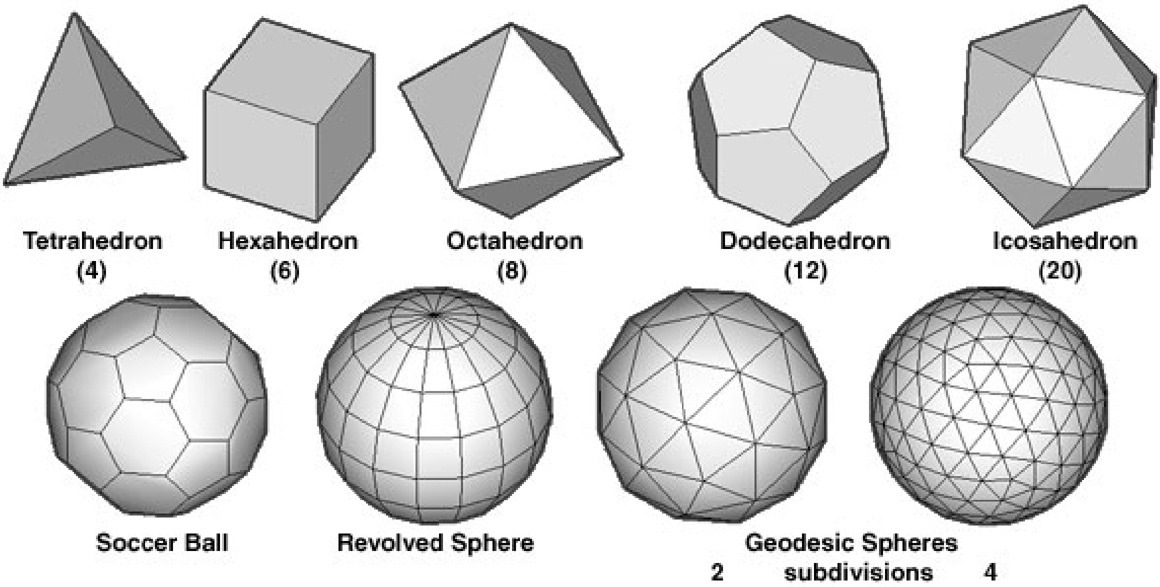
Tool Options – Spherical

Dimensions
Radius X 4'-0"
Radius Y 4'-0" ☑
Radius Z 4'-0"

Shape: Geodesic Sphere

Geodesic
● # Of Subdivisions 2
○ Edge Size 4'-0"

The Spherical tool options palette



Spherical Objects

As shown, the geodesic spheres can be of different densities, which is set through the **Geodesic** group of options in the tool options palette. The density can be specified by using either the **# Of Subdivisions** or the **Edge Size** method.

Transforming objects

The **Transform** suite contains five direct methods for transforming entities, such as objects, object parts, lights, and guides: move, rotate, uniform scale, independent scale, and mirror. Each has its own tool. In the tool options palette, there are options that allow to transform an entity with or without copying it. Copying only affects objects, lights, and guides, but not parts of objects, such as faces, segments or points. Segments of objects can also be transformed with the **Extend** tool, which is also contained in the **Transform** suite.

Transform Texture Map Control is an option for all of the transformation tools (**Move**, **Rotate**, **Independent Scale**, **Uniform Scale**, **Mirror**, **Mirror About**, and **Transform**). When this option is on, an object's texture map control is transformed with the object. This option is on by default and represents how texture controls were handled in prior versions. When this option is off, the texture map control is not transformed with the object. This can be useful, for example, when scaling an object where the texture scale is important, such as a brick pattern.

Move

When entities are prepicked, the first click in the window defines the start point of the move and the second click the end point. Between the two clicks the entities are moved interactively. By default, the two clicks are mapped on the current reference plane or are snapped to object parts or guides. This will allow you to move the entities parallel to the reference plane or from one snapped point to another. To move the entities perpendicular to the plane, hit and release the ***command*** key (Macintosh) or ***ctrl*** key (Windows), which will constrain the move to the plane's perpendicular direction. Hitting the ***command/ctrl*** key again restores the parallel move direction.

When the **Move** tool is activated and no entities are prepicked, the first click picks an entity and also starts the move.

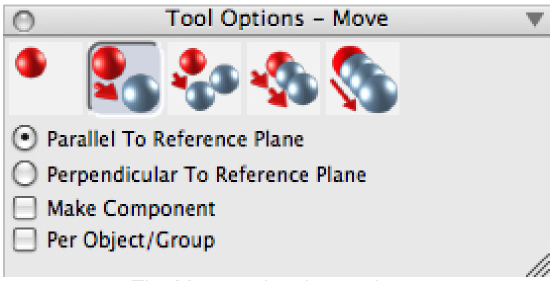
Rotate

Independent Scale

Uniform Scale

Unlike the **Move** tool, when no entities are prepicked, the first click only picks an entity. A second click defines the base point of the transformation (center of rotation, fixed point of the scale, etc). A third and fourth click determine the beginning and the end of the transformation, respectively. No perpendicular option is applicable to these tools.

As already mentioned, the tool palette for all the transformation tools contain a set of icons for specifying whether to apply the operation to the entity itself or to one or more copies.



● Parallel To Reference Plane
○ Perpendicular To Reference Plane
☐ Make Component
☐ Per Object/Group

The Move tool options palette.

Self: When on, it applies the transformation to the entity itself.

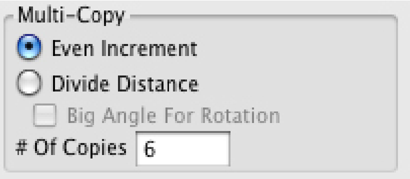
With **Self** on, the **Allow Snap To Original** option appears in the tool options palette and may be turned on or off. If on, the cursor snaps to the original object, which allows, for example, to move an object exactly on top of itself.

One Copy: Makes one copy and transforms the copy.

Continuous Copy: Continues to make a copy at the location of each click of the mouse, until the mouse is double clicked, which terminates the operation.

Repeat Copy: Continues to make a copy with each click of the mouse by repeating the original transformation. Double clicking terminates the transformation.

Multi Copy: When this option is selected, additional options appear in the tool options palette. The number of copies to be made is entered in the **# Of Copies** field. These can be made by repeating the value applied to the first copy (**Even Increment**) or by subdividing that value by the number of copies (**Divide Distance**).


Multi-Copy
● Even Increment
○ Divide Distance
☐ Big Angle For Rotation
Of Copies 6

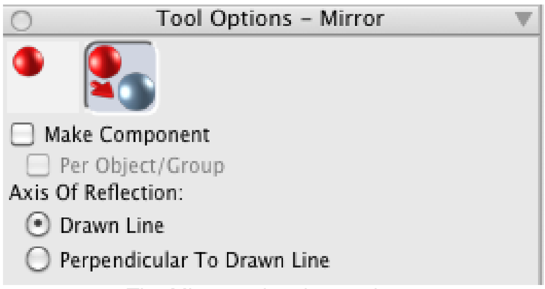
Additional options in the tool options palette when Multi Copy is on.

When applying the latter option to rotations, there are two complementary angles that may be subdivided. Which one is used depends on whether the **Big Angle For Rotation** option is on or off. When **Self** is on and an object part is transformed, it stays with its object. If one of the **Copy** options is on, a copy of the part is made as a separate object and is transformed, while the original object remains intact.

When one of the copying modes is on, the **Make Component** and **Per Object/Group** options appear in the palette. When the former is on, a component is automatically made from the selected entities and the copies become instances of the new component. If more than one entities are picked, they all become a single component, unless **Per Object/Group** is on in which case each original object becomes a separate component.

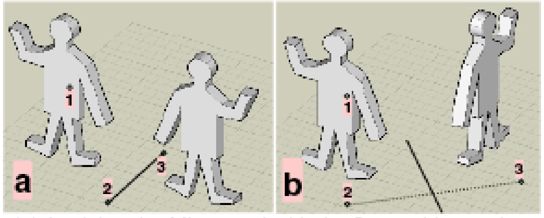
Mirror

This tool dynamically reflects an object about an axis. It operates only on complete objects and not on object parts. With the tool active click on an object to select it, then click twice on the reference plane to define the axis of reflection. The line defined by the two points is the axis itself, if the **Drawn Line** option is on. If instead the **Perpendicular To Drawn Line** option is on, the axis is a line perpendicular at the midpoint of the line you draw. See examples on the right.


Tool Options – Mirror
☐ Make Component
☐ Per Object/Group
Axis Of Reflection:
● Drawn Line
○ Perpendicular To Drawn Line

The Mirror tool options palette.

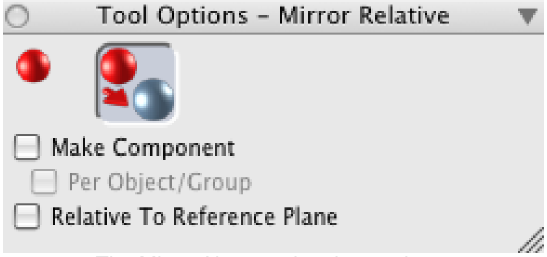
The **Mirror** tool can be applied on the object itself or on a copy. When **Copy** is selected, you can also instruct the program to make a component from the copy.



(a) Applying the Mirror tool with the Drawn Line option: Clicking on 1 selects the object. Then clicking on 2 and 3 defines the axis of reflection.
(b) Applying the Mirror tool with Perpendicular To Drawn Line on: Clicking on 1 selects the object. Clicking on 2 and 3 defines an axis of reflection as a line perpendicular to the line drawn .

Mirror About

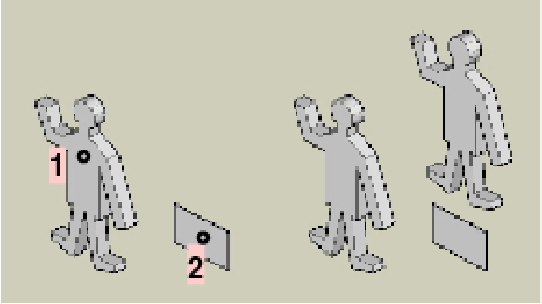
This tool reflects objects in one step rather than dynamically. With the tool active click on an object then on a surface, a line, or a point, which becomes the entity of reflection. See example on the right.


Tool Options – Mirror Relative
☐ Make Component
☐ Per Object/Group
☐ Relative To Reference Plane

The Mirror About tool options palette.

As with the **Mirror** tool, the **Mirror About** tool can be applied to the object itself or to a copy. When the latter is selected, you can also instruct the program to make it a component.

When an object is reflected about a line or a point, it will be reflected relative to the three axes (X, Y, and Z). If **Relative To Reference Plane** is on then it will be reflected relative to the axes of the reference plane only.

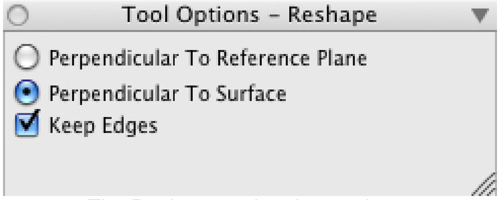


Applying the Mirror About tool: Clicking on 1 selects the object. Clicking on 2 selects the surface about which it will be mirrored.

Reshape

The **Reshape** tool combines an extrusion of a face with a **Boolean Union** or **Difference** in an interactive operation. After a face is picked, it is extruded interactively. If the object is a solid and the extrusion direction is outwards from the face, the extruded shape is unioned with the solid. If the extruded direction is inwards from the picked face, the extruded shape is subtracted from the solid.

The extrusion direction may be **Perpendicular To Reference Plane** or **Perpendicular To Surface** of the picked face, which is selected from the tool options palette. The option may be toggled while extruding by hitting the ***command*** key.


Tool Options - Reshape

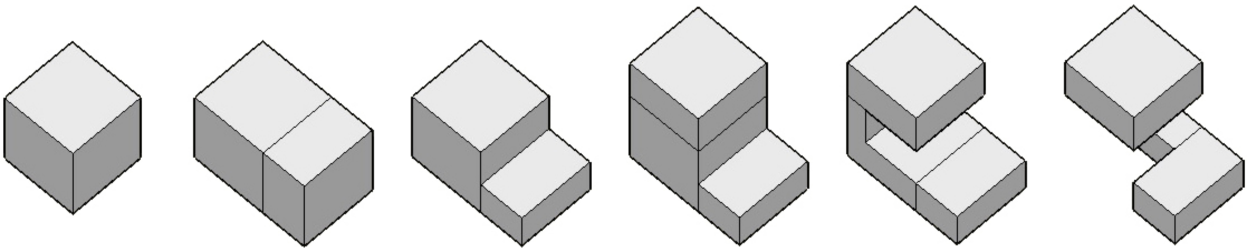
○ Perpendicular To Reference Plane

● Perpendicular To Surface

☑ Keep Edges

The Reshape tool options palette.

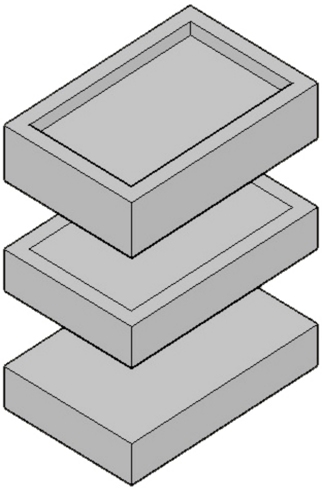
The **Keep Edges** option determines, whether edges along coplanar faces are kept or removed when moving in the outward direction. Keeping the edges is useful for creating more faces for further reshaping. The **Keep Edges** option can be toggled during the interactive operation by pressing and releasing the ***shift*** key.



Reshaping a cube with Keep Edges on.

Offsetting and reshaping work well together in creating more complex geometry from initially simple shapes. For example, to create the parapet on a flat roof, offset the top face of the roof inward. Next pick the outer split face and reshape it upward by the desired distance. See example on the right.

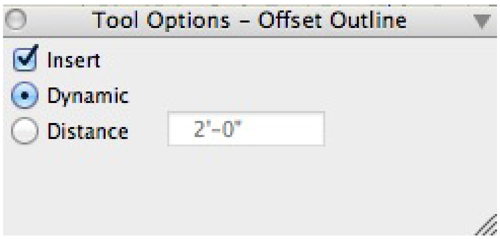
Reshaping with the **Keep Edges** option can be useful when you are modeling in conjunction with the subdivisioon surface suite of tools. Keeping edges as you work on an underlying facetted cage can help to manage the location of edges and sequences in the subdivided surface.



Creating a parapet on a flat roof.

Offset Outline

This operation produces a new shape that is parallel to the shape of the picked outline. This new shape may be inserted into the original shape or it may become a new independent object. More than one outline can be offset at a time, but they must all be planar. You can pre-pick faces with the **Pick** tool set to **Face** or you can hold down shift and add faces to your selection after you have activated the tool.



Tool Options – Offset Outline

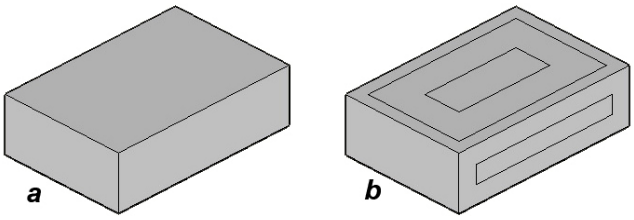
☑ Insert

● Dynamic

○ Distance 2'-0"

The Offset Outline tool options.

Dynamic: This option allows for interactively offsetting an outline with two clicks. The first click picks the outline and starts the interactive operation. The second click ends the interactive offsetting and determines the final offset distance. If offsetting is toward the inside of the face, the new shape is automatically inserted into the face, when the **Insert** option is on. If offsetting is toward the outside or the **Insert** option is off, a new separate object is created. so that the appropriate distance can be judged visually. It should be noted that it is still possible to set the offset value numerically, but one could visually test a distance and then enter a round number for the actual value.

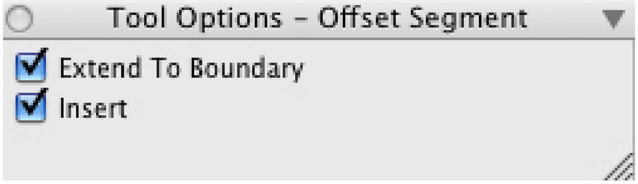


(a) A cuboid and
(b) offsetting three outlines.

Distance: When this option is selected, the offset is applied at the specified distance when the mouse is clicked on an object's face. This applies the offset directly, without interactivity. The newly created outline remains selected to allow for repeated operations if desired.

Offset Segment

This tool is similar to offsetting outlines, except that it works on segments. It also requires two clicks. After a segment is selected with the first click, it is offset parallel to its direction in the plane of its adjacent face. The second click ends the interactive offsetting. If the segment is linear, its ends are extended to always meet the boundary of the face in which it is offset and it is inserted into the face. If the segment is an arc or spline, it is offset parallel and its ends are extended along their tangent directions.

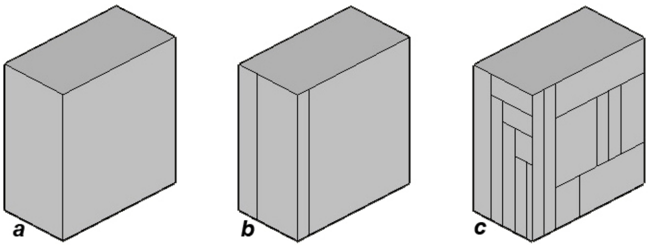


Tool Options - Offset Segment

☑ Extend To Boundary

☑ Insert

The Offset Segment tool options.



(a) A cuboid. (b) Offsetting two of its vertical segments.
(c) Offsetting more segments.

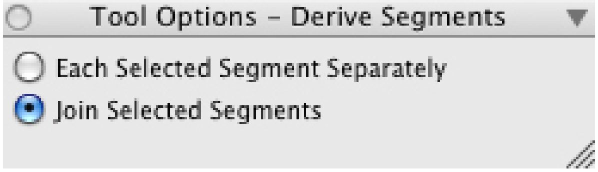
If a segment is adjacent to two faces, it is offset on the face over which the cursor is placed. If you wish to offset a segment beyond the bounds of its face and also wish to force it to stay on the plane of the face, keep the shift key down while over the face and then move the cursor outside the face.

By default, segment ends are always extended and are inserted, if possible. This can be changed by deselecting the **Extend To Boundary** and **Insert** options in the tool palette.

Derive Segment

This tool is used to derive objects consisting of one or more segments of another object. To apply it, with the tool active, click on a segment of an object, which will result in a single segment object. If more segments need to be picked, they should be picked as a set. Or, alternatively, the prepick method can be used. That is, with the **Pick** tool select all the segments you wish to be included in your new object, then activate the **Derive Segment** tool and click somewhere in the project window. Whether the selected segments will become a single object or many objects, one per segment, depends on the option checked in the **Derive Segment** tool options palette. The two options are: **Each Selected Segment Separately** and **Join Selected Segments** (default).

After the operation is completed and the new object(s) is created, the original object is ghosted. It can be unghosted using the respective tool. Examples are shown to the right.

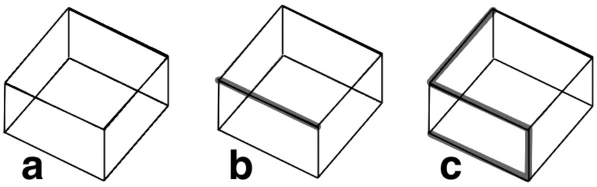


Tool Options - Derive Segments

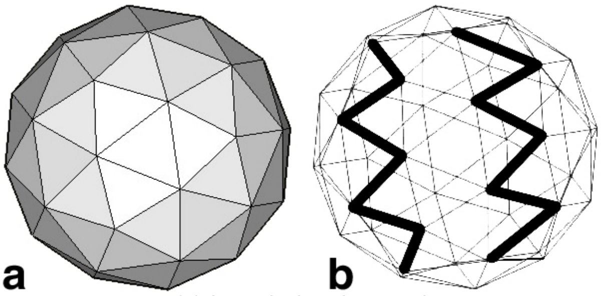
○ Each Selected Segment Separately

● Join Selected Segments

The Derive Segments tool options palette.



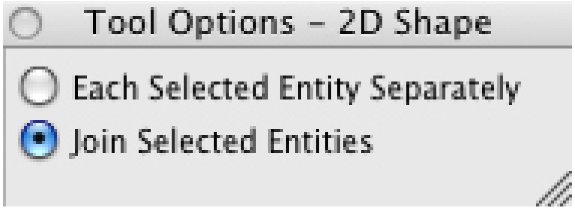
(a) A cube, (b) deriving a segment, and (c) deriving four segments.



(a) A geodesic sphere and (b) deriving two sets of segments.

Derive Face

This tool is used to derive a surface object from a face of another surface or solid object. To do so, with the tool active, click on a face. The surface is generated immediately and the original object is ghosted. You can pick more than one face to derive 2D surface objects from all of them in one step. In the latter case two options are available in the tool options palette:



Tool Options - 2D Shape

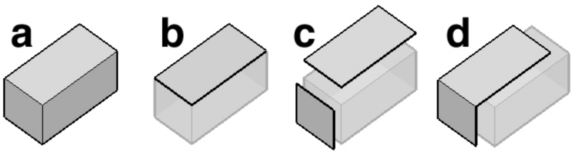
○ Each Selected Entity Separately

● Join Selected Entities

The 2D Shape Tool Options palette.

Each Selected Entity Separately: With this on, a separate surface object is generated for each selected face.

Join Selected Entities: With this on, all surfaces that touch at a common edge become a single object. With wires, all segments that connect become one object.



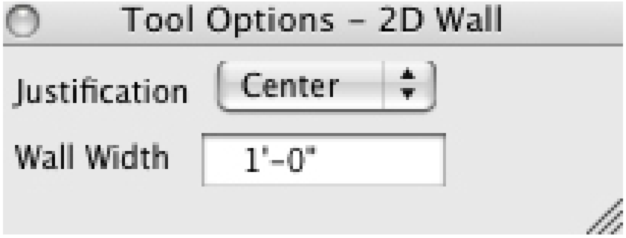
Deriving 2D Surface objects:
(a) Original object. (b) Surface from single face. (c) (d) Surfaces from multiple face picks. With (c) Each Selected Entity Separately and (d) Join Selected Entities on.

2D Wall

This tool is used to derive 2D wall (double line) objects from selected faces, outlines, or segments. It is executed as the **2D Surface** tool, except that, for this operation, the original object is not ghosted. When multiple entities are selected, a separate object is always created from each pick. There are two options:

Justification: This can be **Left**, **Center**, or **Right**.

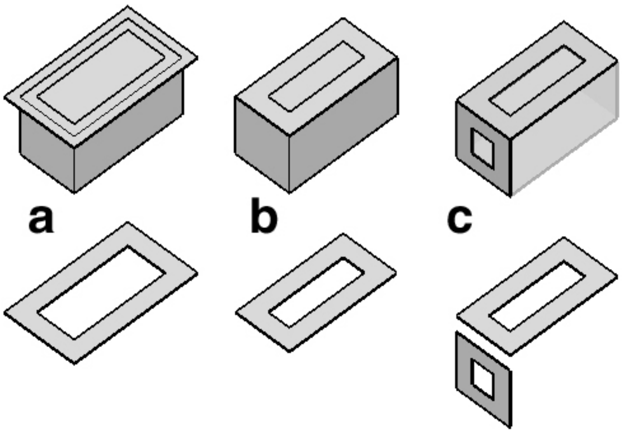
Wall Width: This specifies how far apart the parallel lines of the wall are.



Justification: Center

Wall Width: 1'-0"

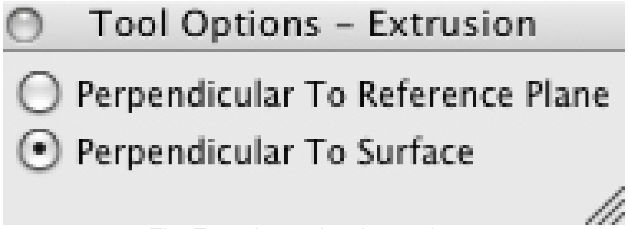
The 2D Wall Tool Options palette.



Deriving 2D Wall objects:
Justification at (a) Center and
(b) Left. (c) Multiple picks return
separate objects always.

3D Extrusion

This tool is used to extrude faces, outlines, or segments of objects. To execute the operation, with the tool active click on an entity, then move the mouse up or down to define a height. The extrusion can be **Perpendicular To Reference Plane** or **To Surface**, which is selected from the tool options palette.

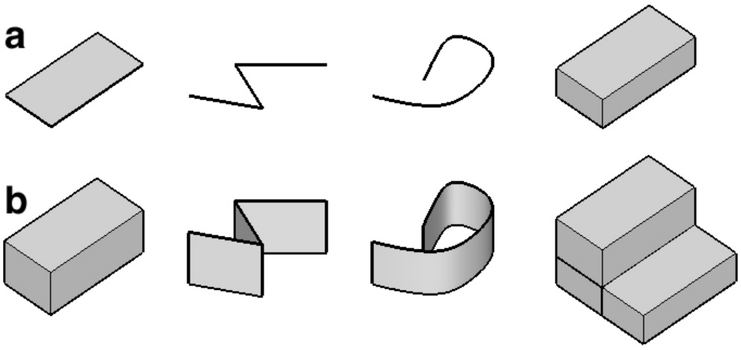


Tool Options – Extrusion

○ Perpendicular To Reference Plane

● Perpendicular To Surface

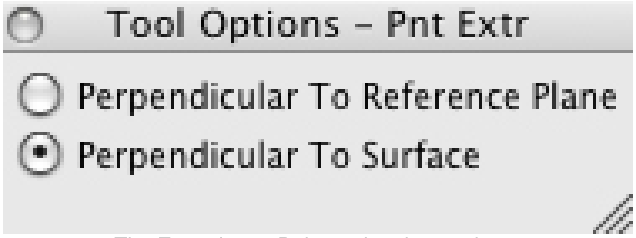
The Extrusion tool options palette.



Extruding faces: (a) original and (b) derived.
Two objects are derived from the far right cube.

3D Extrusion to Point

This tool works as the **3D Extrusion** tool, except that the extrusion it generates converges to a point. Its tool options palette contains the same options as for the **3D Extrusion** tool.

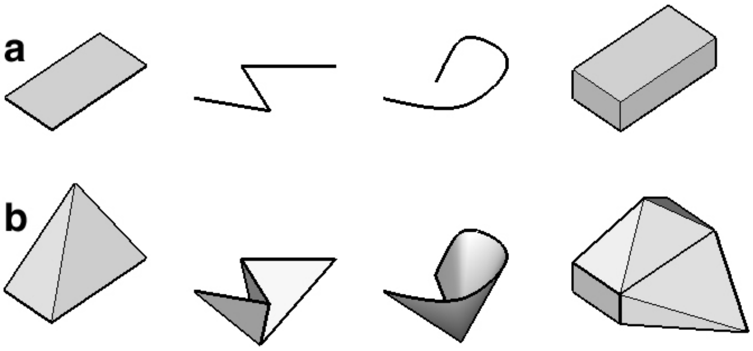


Tool Options – Pnt Extr

○ Perpendicular To Reference Plane

● Perpendicular To Surface

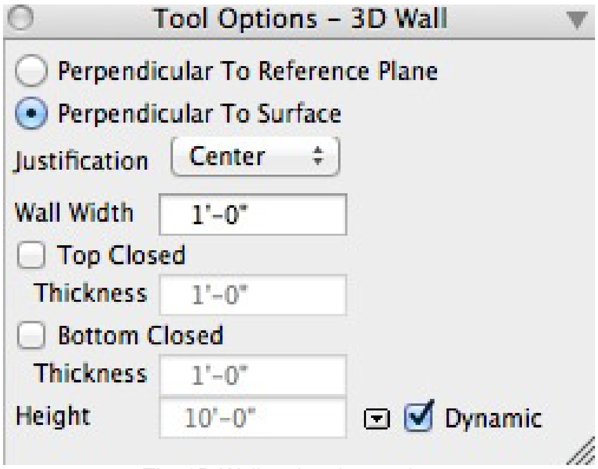
The Extrusion to Point tool options palette.



Extrusions to point:
(a) original and (b) derived objects.
Negative heights were applied to the wires.
Two objects were derived from the far right cube.

3D Wall

This tool is a combination of the **2D Wall** and the **3D Extrusion** tools. That is, it first generates a 2D wall from selected entities, which it then extrudes to derive 3D walls. Consequently its tool options palette contains the options for the 2D wall and the options for the extrusion.



Tool Options – 3D Wall

○ Perpendicular To Reference Plane

● Perpendicular To Surface

Justification: Center

Wall Width: 1'-0"

☐ Top Closed

Thickness: 1'-0"

☐ Bottom Closed

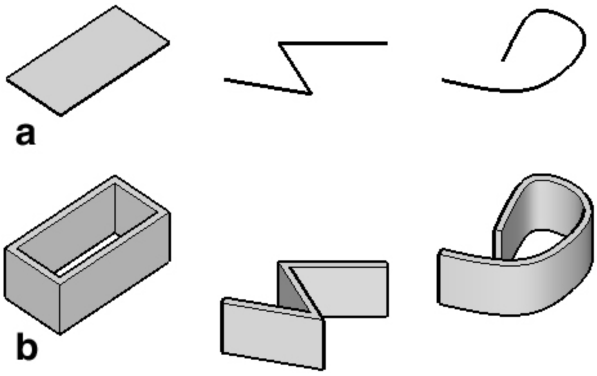
Thickness: 1'-0"

Height: 10'-0" ☑ Dynamic

The 3D Wall tool options palette.

Top Closed adds a "ceiling" to the area affected by the 3D Wall operation. The **Thickness** value in the box below determines the distance between the top face of the ceiling and the bottom face. **Bottom Closed** adds a "floor" to the area, and the **Thickness** value here likewise determines the distance between the top face of the floor and the bottom face.

Height allows setting the value of the **3d Wall** so that each time it is used, the value will be used. If **Dynamic** is checked, then the height is determined interactively while the wall is being extruded.



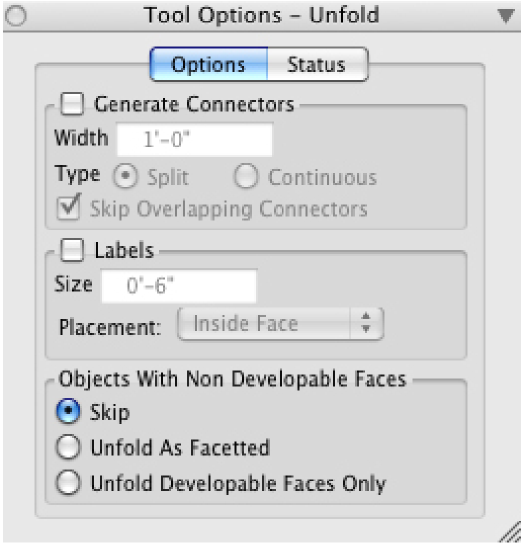
Deriving 3D Walls:
(a) Original and (b) derived objects.

Unfold

This tool is used to unfold objects, which can be surfaces or solids, facetted or smooth, except in the latter case they need to consist of developable surfaces or otherwise they can only be unfolded by converting them to facetted. These and other options can be set in the **Unfold Tool Options** palette.

Generate Connectors: These only apply to facetted objects and when on the program generates extensions at the edges of the unfolded pieces to be used to glue corresponding edges together. There are two types: **Split** an **Continuous**. They are illustrated below. When unfolded edges meet at tight angles, it is possible for connectors to overlap. You can instruct the program to **Skip Overlapping Connectors** or accept them as they are.

Labels: You can instruct the program to generate numeric labels that mark corresponding edges. For complex objects, the labels help reassemble to object. You can set the **Size** of the labels and can choose one of three positions from the **Placement** pop-up menu. See example below.


Tool Options - Unfold

☐ Generate Connectors

Width 1'-0"

Type ● Split ○ Continuous

☑ Skip Overlapping Connectors

☐ Labels

Size 0'-6"

Placement: Inside Face

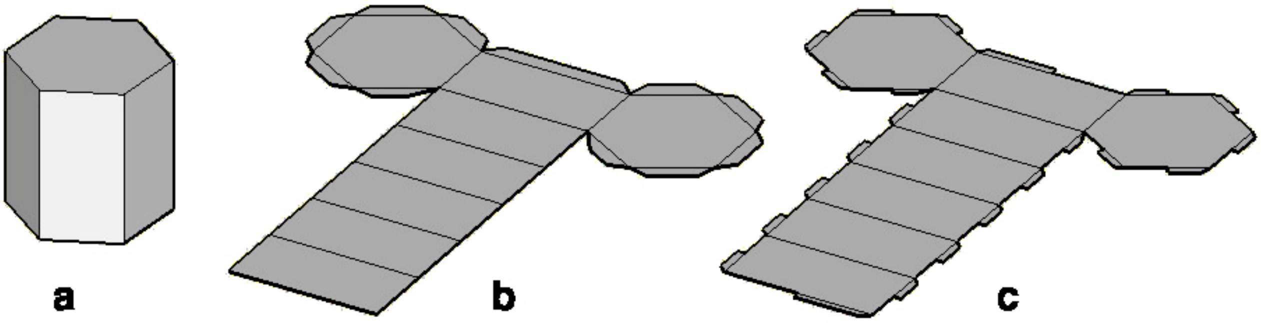
Objects With Non Developable Faces

● Skip

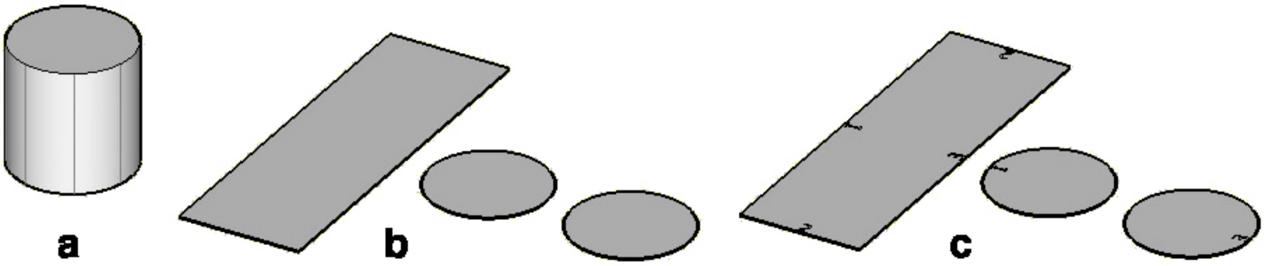
○ Unfold As Facetted

○ Unfold Developable Faces Only

The Unfold tool options palette.

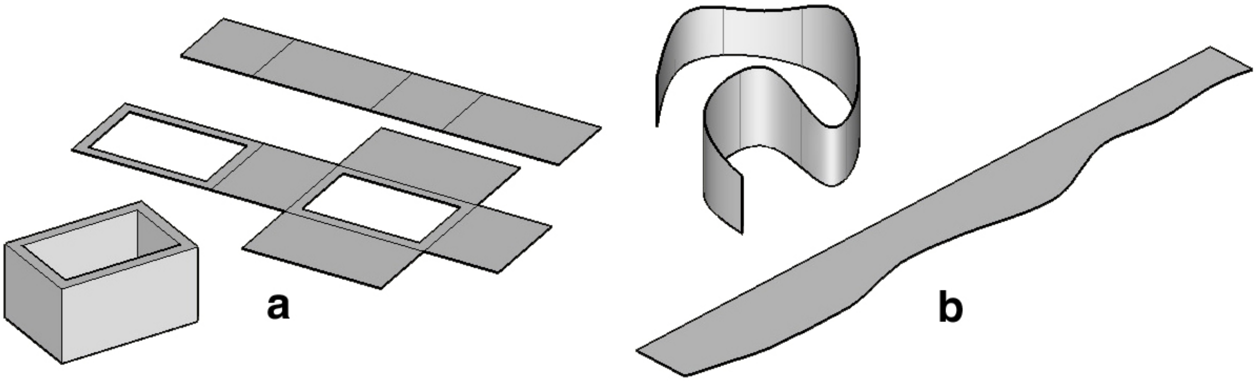


Unfolding hexagonal extrusion with (b) Continuous and (c) Split connectors.

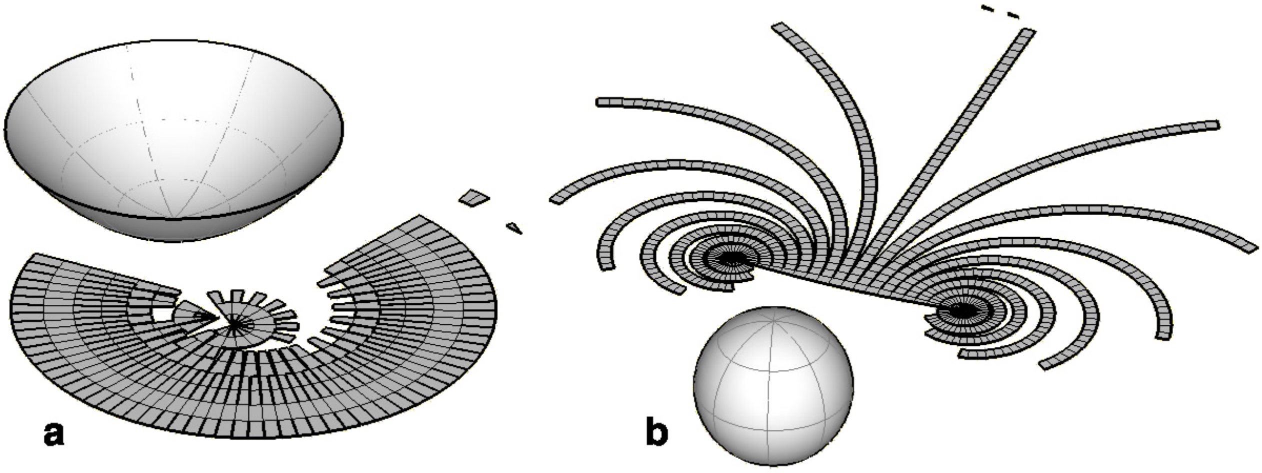


Unfolding a cylinder (b) without and (c) with labels.

Objects With Non Developable Faces: Developable are surfaces that have been generated by sweeping a straight line, possibly on a curvy path. Surfaces that have multi-directional curvatures are not developable. The surfaces of facetted objects can always be unfolded. Smooth objects can only be unfolded when they consist of developable surfaces. If not, one of three options can be selected from the tool options palette: **Skip**, **Unfold As Facetted**, or **Unfold Developable Faces Only**. Examples are given below.



(a) Unfolding a 3D enclosure (wall object). No matter how complex
it may be, it is always facetted and it will be unfolded.
(b) Unfolding an extruded spline. Being curved in one direction it can be unfolded.



Unfolding (a) a paraboloid and (b) a sphere.
They both have multi-directional curvatures and are not developable.
They have been unfolded by converting them to facetted

The **Unfold** tool is applied by clicking with it on the object to be unfolded. When the object is facetted, where you click is significant, as the unfolding starts with the segment that is the closest to the pick point. Consequently, picking at different points results in different unfolding patterns. When the object is smooth, where you click is insignificant.

Revolve

This tool is used to derive a revolved or lathed object from a profile (source shape) and an axis. The axis can be another object or an axis of the Cartesian coordinates system. See examples of both.

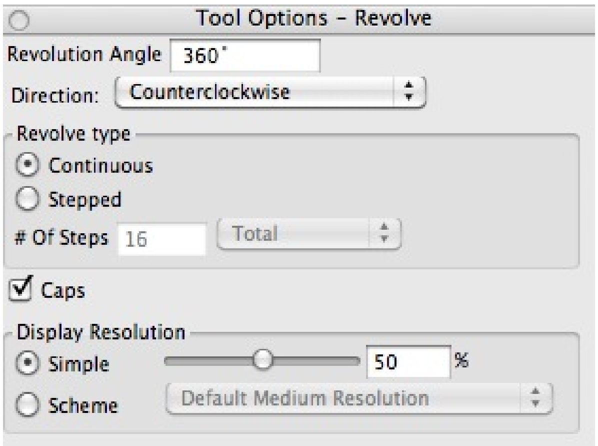
To revolve a shape, with the **Revolve** tool active, click on the shape and on the axis. You can also use prepicking to revolve a number of shapes about the same axis in one step. After its generation the revolved object remains in edit mode and its controls can be manipulated to change its shape. Changes can also be made through the settings in its **Tool Options** palette.

Angle: Expressed in degrees, determines the extent of the revolution. Default is 360°, which is a complete revolution. Partial revolutions are also possible, as shown.

Direction: The revolution can occur **Clockwise** or **Counterclockwise**.

Revolve Type: The revolution can be **Continuous**, producing a smooth object, or **Stepped**. When the latter, **# Of Steps** determines how many steps will be generated, which can be relative to the Total revolution or the given **Angle**.

Cap: When closed shapes are partially revolved this option determines whether to close (cap) their ends or not.



Tool Options - Revolve

Revolution Angle 360°

Direction: Counterclockwise

Revolve type

● Continuous

○ Stepped

Of Steps 16 Total

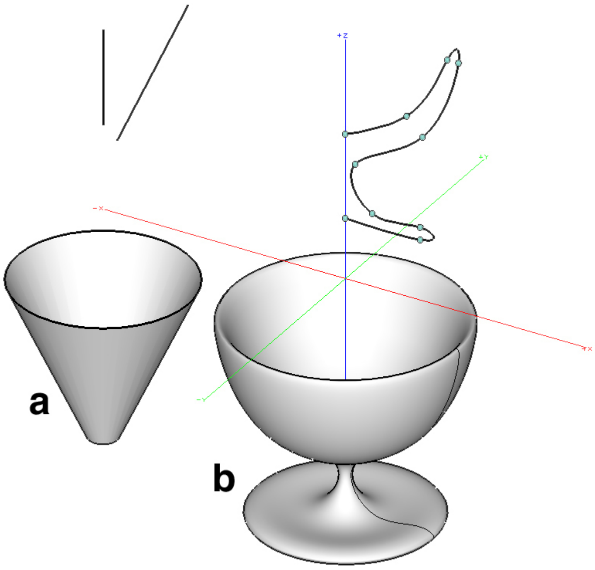
☑ Caps

Display Resolution

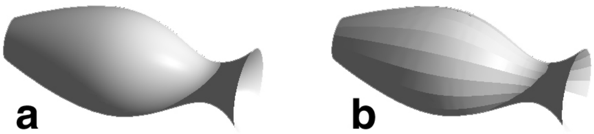
● Simple 50 %

○ Scheme Default Medium Resolution

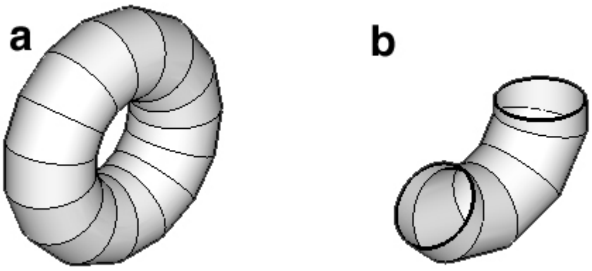
The Revolve tool options palette.



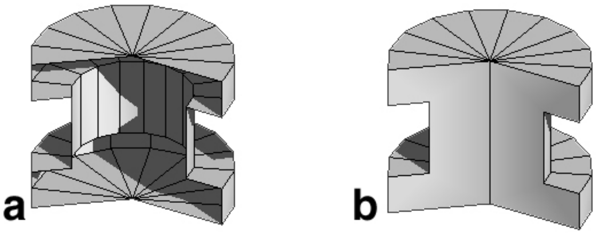
Revolving about
(a) another object as axis
and (b) a Cartesian axis.



(a) Continuous and (b) stepped.

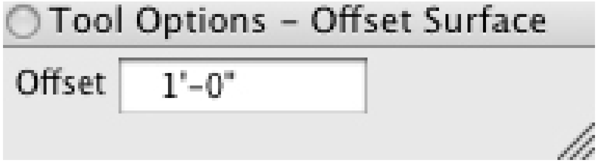


(a) Complete and (b) partial revolution.



Cap (a) off and (b) on.

Offset Surface

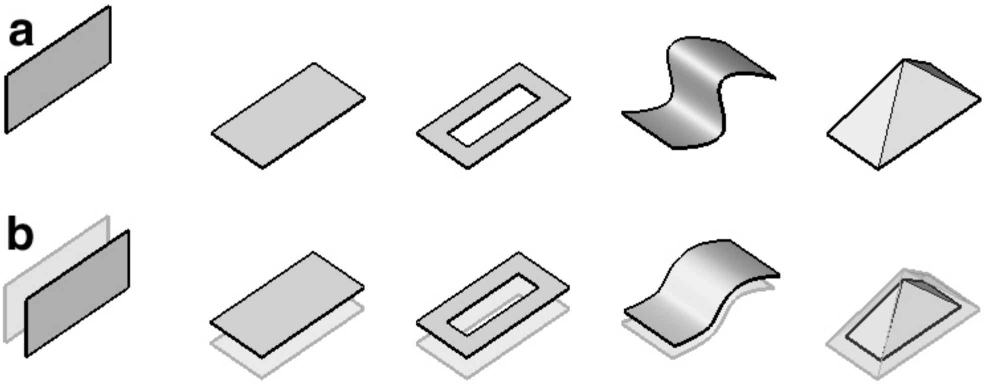

Tool Options - Offset Surface

Offset 1'-0"

The Offset Surface Tool Options palette.

This tool is used to offset a surface or a solid at a given distance, which is the only parameter in its tool options palette.

To execute this operation, with the tool active, click on the surface to be offset. The operation is executed immediately and the original object is ghosted. The prepick method can also be used to offset more than one surface in one step. See examples below.

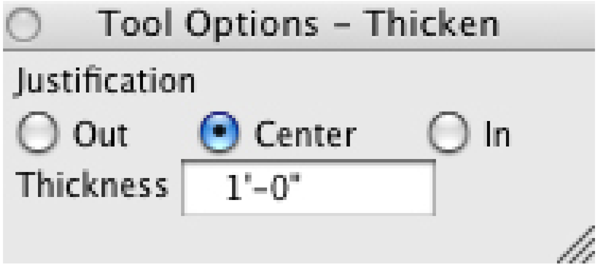


Thickening a variety of surfaces: (a) original and (b) resulting surfaces.

Thicken

This tool is used to offset a surface on both sides and, by closing its edges, it produces a solid. In other words, it adds thickness to a surface with no volume. It is executed as the **Offset Surface** tool. Its tool palette also includes a **Justification** option, which determines how the offset surfaces will be positioned relative to the original.

When this tool is applied to a solid object, the solid becomes hollow with a wall thickness of the given value.



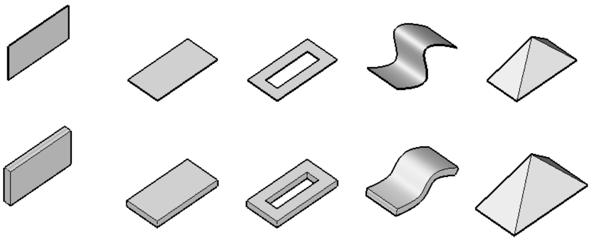
Tool Options – Thicken

Justification

○ Out ● Center ○ In

Thickness 1'-0"

The Thicken Tool Options palette.



Thickening a variety of surfaces: (a) original and (b) resulting surfaces.

Stairs from Path

Straight stairs can be generated from path shapes that can be open or closed. They can be generated using either the prepick or postpick mode.

In prepick mode, with the **Stairs from Path** tool active, click on a path and the stair is generated immediately. However, it is still in edit mode and its parameters can be further manipulated either through graphic or numeric input. See examples of stairs. In postpick mode, with the **Pick** tool prepick any number of path shapes and then, with the **Stairs** tool, click anywhere in the project window.

The parameters of the stairs are set in the **Stairs from Path Options** palette, which contains four tabs: **Options**, **Tiles/Sides**, **Railings**, and **Limits**.

Type: There are four stair types and two ramp types, which are selected by selecting the respective icon in the palette. See examples.

Layout: There are three layouts, which are picked through their icons. The first generates continuous steps per segment of the stair. The second generates continuous steps throughout the stair and the third generates landings at each turn of the path line, resulting in all steps being rectangular shapes. See examples.

Align: The sides of the stair are parallel to the path line and can be centered or aligned to the left or right, which is selected from this pop-up menu.

Width: The value typed in this field is the width of the stair.

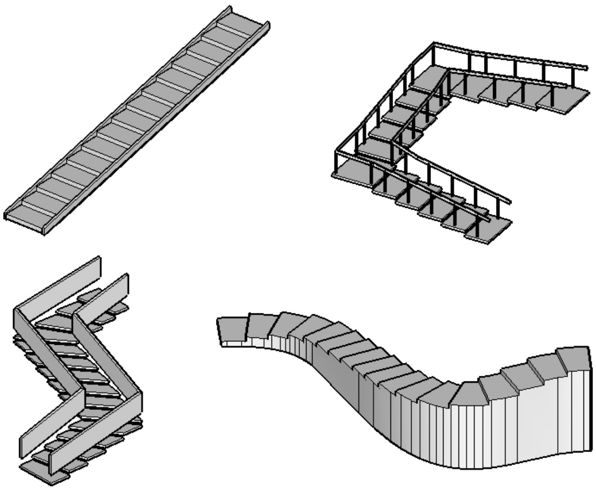
Height: The value in this field represents the height of either the whole stair (**Total**) or each flight (**Per Flight**), set in the pop-up menu.

# Of Flights: The number of flights.

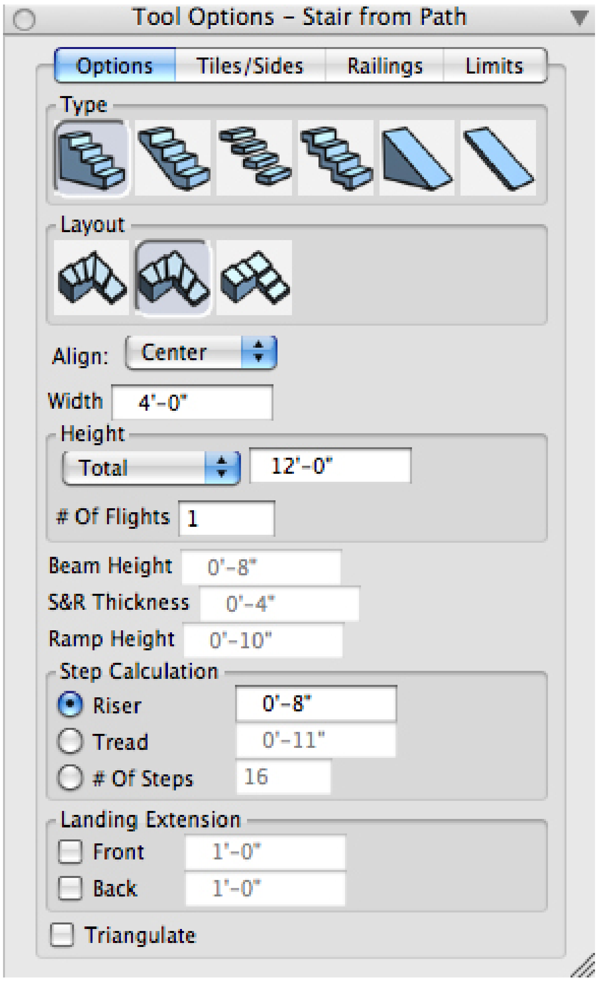
Beam Height: When a beam stair is generated (2nd icon from left) this value determines the height of the beam.

S&R Thickness: When a steps only or a steps and risers type of stair is generated (3rd and 4th icons from left), this value specifies the thickness of the slabs of the steps and risers, if any.

Ramp Height: Applies only to the beam ramp (icon on the right end) and specifies the height of its beam.



Examples of stairs from path.



Tool Options – Stair from Path

Options | Tiles/Sides | Railings | Limits

Type

Layout

Align: Center

Width 4'-0"

Height

Total 12'-0"

Of Flights 1

Beam Height 0'-8"

S&R Thickness 0'-4"

Ramp Height 0'-10"

Step Calculation

● Riser 0'-8"

○ Tread 0'-11"

○ # Of Steps 16

Landing Extension

☐ Front 1'-0"

☐ Back 1'-0"

☐ Triangulate

The Options tab of the Stairs from Path options palette.

Step Calculation: The height (**Riser**) and depth (**Tread**) of the steps are defined by entering values in the respective fields or by typing a value for **# Of Steps**. These fields are correlated and are adjusted when values are entered to the other ones.

Landing Extensions: When the 3rd layout is generated (with landings), the landings may extend at their **Front**, **Back**, or both. How much depends on the values in the respective fields.

Triangulate: When on, any non-planar surfaces of the stair are triangulated.

Stairs can be generated **With Tiles** on their steps and/or **With Side Beams**, which is controlled by options found in the **Tiles/Sides** tab.

Height, Front, Sides: These values determine the size of the tiles.

Width, Above, Under: These values specify the size of the side beams.

Flat At Landings: When a with landings type of layout is generated, at the landings, the side beams may follow the overall slope of the stair or they may be locally horizontal, following the flat slope of the landings.

Stairs may or may not have railings, which is controlled by settings in the **Railings** tab.

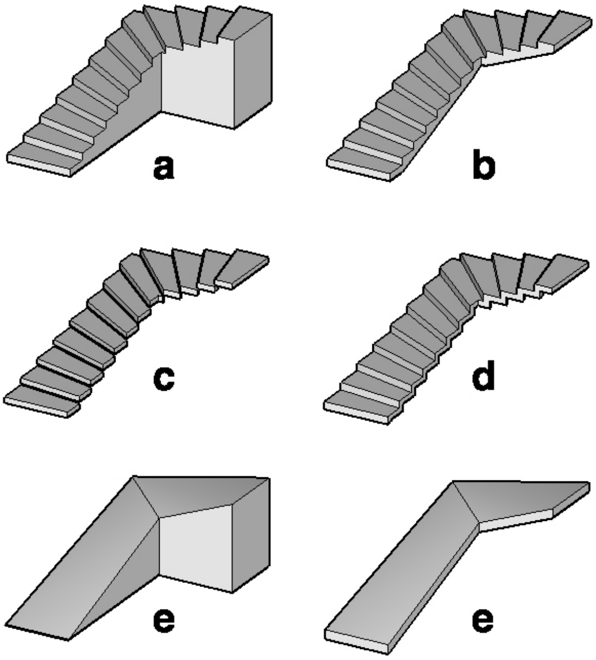
For both rails and columns, a shape can be selected (wire, square, or round). The wire is intended to offer the ability to sweep any shape of a profile after the stair has been generated.

Height: Sets the height of the rails.

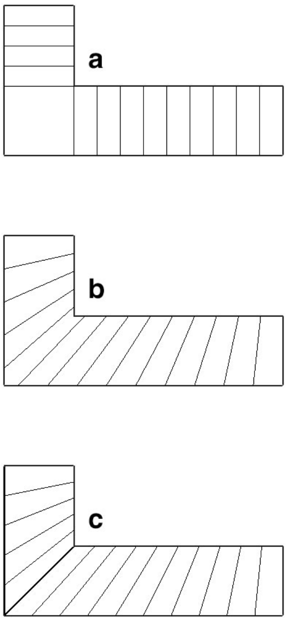
Distance From Edge: Specifies the positions of the columns relative to the edge of the stair.

Flat At Landings: As for side beams.

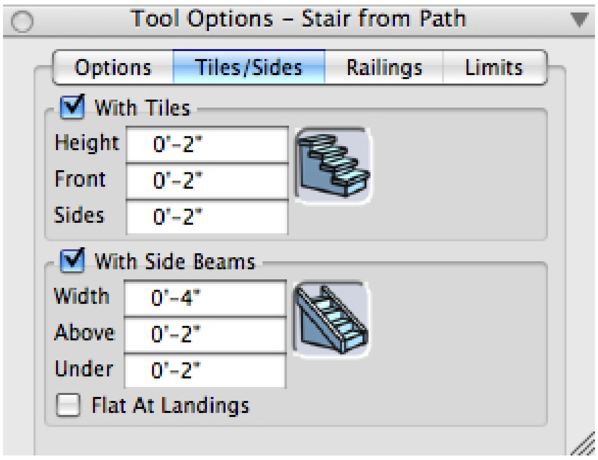
The **Limits** tab allows you to request that you be warned when certain limits are exceeded relative to the treads and risers of the steps.



Types of straight stairs: (a) solid, (b) beam, (c) steps only, (d) steps and risers, (e) solid ramp, and (f) beam ramp.



Types of straight stairs: (a) solid,(b) beam, (c) steps only, (d) steps and risers, (e) solid ramp, and (f)beam ramp.



☑ With Tiles

Height 0'-2"

Front 0'-2"

Sides 0'-2"

☑ With Side Beams

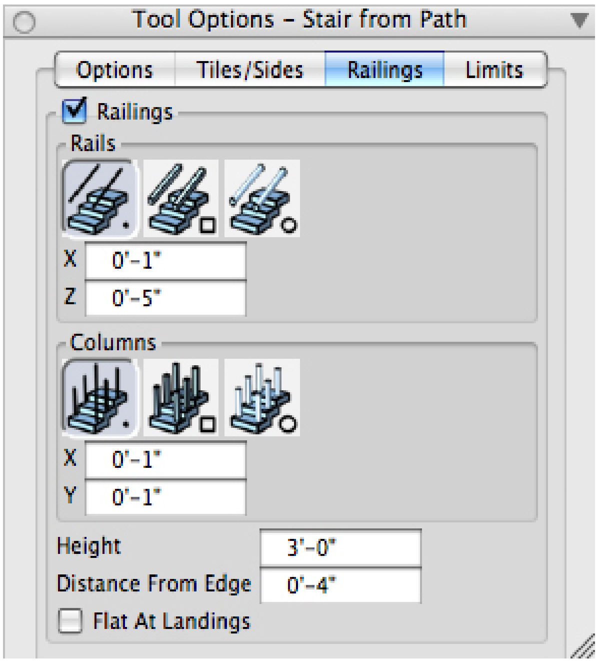
Width 0'-4"

Above 0'-2"

Under 0'-2"

☐ Flat At Landings

The Tiles/Sides tab of the Stairs from Path tool options palette.



☑ Railings

Rails

X 0'-1"

Z 0'-5"

Columns

X 0'-1"

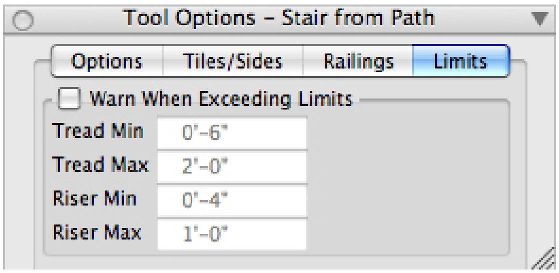
Y 0'-1"

Height 3'-0"

Distance From Edge 0'-4"

☐ Flat At Landings

The Railings tab of the Stairs from Path options palette.



☐ Warn When Exceeding Limits

Tread Min 0'-6"

Tread Max 2'-0"

Riser Min 0'-4"

Riser Max 1'-0"

The Limits tab of the Stairs from Path options palette.

Spiral Stairs

Spiral stairs are generated by clicking with the respective tool on the reference plane to enter a point, which is the starting point of an axis that extends along the Z direction. This axis is used to revolve a spiral stair around it, according to parameters set in the **Spiral Stairs Options** palette.

Step Width: This group of values sets the shape of the stair.

Inside Radius, Outside Radius: They specify the radius closest and farthest to the axis, respectively.

Width: The difference between the inside and outside radii gives the width of the stair. However, the width can also be specified by typing a value in this field, which will cause the outside radius to be adjusted accordingly.

Height Control: Once the **Total Height** is set, either the Riser Height or the **# Of Steps** option can be selected to specify the steps. These two values are correlated and when one changes the other is adjusted.

Length Control: One of three parameters can be used to determine the length of the stair. **Total Angle** specifies the total rotation in degrees that will be used to cover the specified height. **Step Angle** specifies an angle per step. In this case the total angle is obtained by multiplying this value with the number of steps. **Step Width** specifies the width of the steps measured halfway between the sides of the stair.

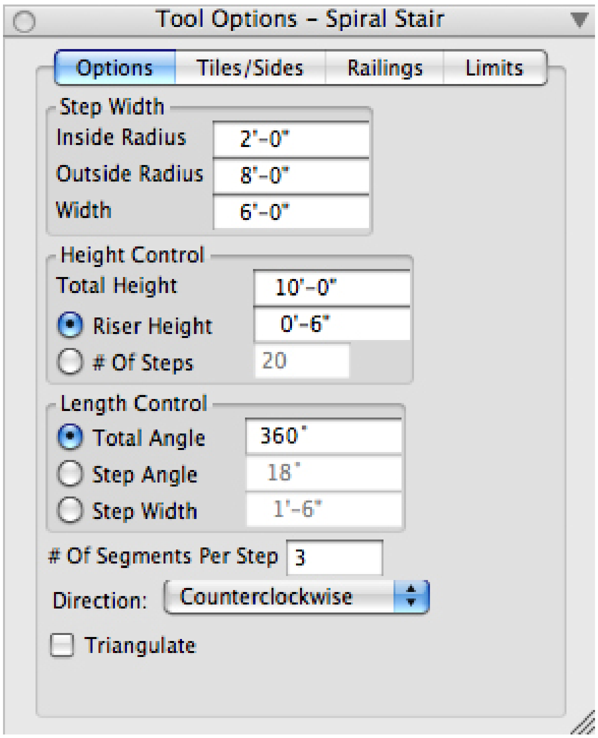
# Of Segments Per Step: The spiral stair is a facetted object and this value determines the density of the facets of the sides and underneath surfaces of the stair.

Direction: One of two directions can be selected from this pop-up menu: **Clockwise** and Counterclockwise.

Triangulate: As for the stair from path.

The **Spiral Stairs Options** palette also has tabs for **Tiles And Sides**, **Railings**, and **Limits**, whose contents are as for the stair from path.

Examples of spiral stairs are shown below, where views of both the upper and the under parts of the stairs are shown, on the left and right, respectively.



Step Width
Inside Radius 2'-0"
Outside Radius 8'-0"
Width 6'-0"

Height Control
Total Height 10'-0"
● Riser Height 0'-6"
○ # Of Steps 20

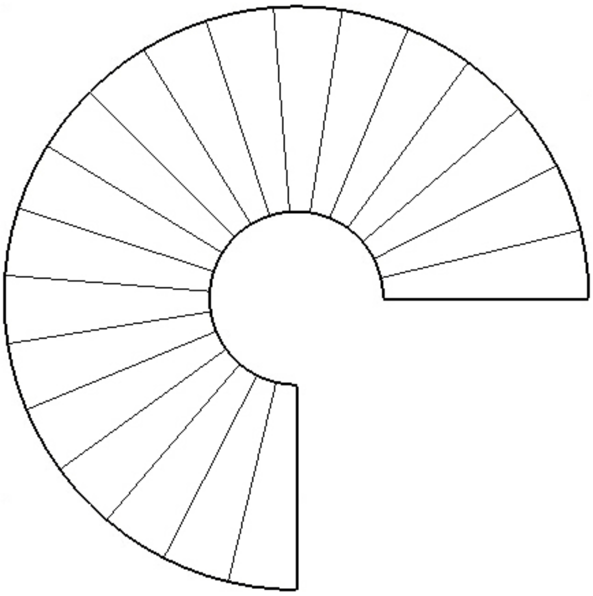
Length Control
● Total Angle 360°
○ Step Angle 18°
○ Step Width 1'-6"

# Of Segments Per Step 3

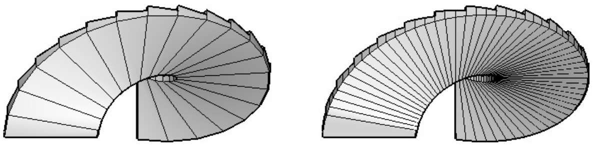
Direction: Counterclockwise

☐ Triangulate

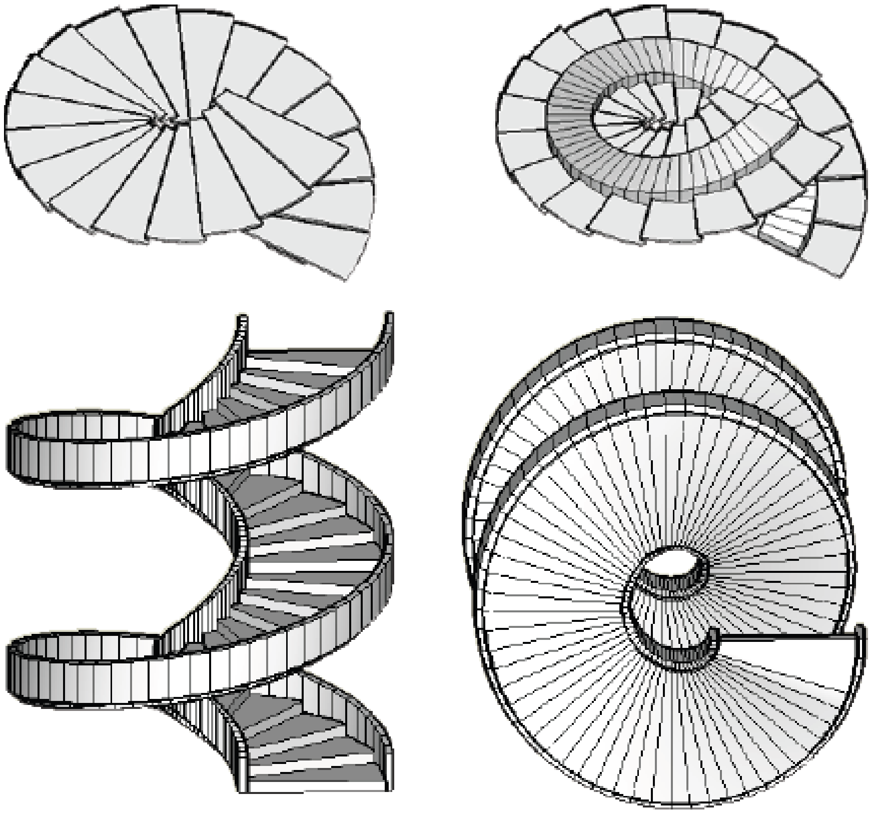
The Options tab of the Spiral Stairs options palette.



Inside and outside radii of the spiral stairs.



# Of Segments Per Step = (a) X and (b) X.



Examples of spiral stairs.

Roof

Roofs can be generated from 2D shapes or from faces of 3D objects, as shown.

They can be generated in postpick or prepick mode. In postpick mode, with the Roof tool active, click on a 2D shape or the face of a 3D object. A roof is generated immediately.

In prepick mode, with the **Pick** tool select any number of 2D shapes and/or faces of objects. Then with the **Roof** tool, click anywhere in the project window. This is illustrated to the right, where four roofs are generated with one operation.

The options of the Roof can be set in the **Tool Options** palette, when the **Roof** tool is active.

Slope: It can be set either as a % or by entering a pair of values for **Rise** and **Run**. The two methods are correlated, that is when a value is entered for one the other is automatically adjusted in the options palette.

Type: There are two types: **Gable** and **Hip**.

The ridge lines of roofs are always along the longest dimension and this is the only option available when hip roofs are generated. When gable roofs are generated from rectangular shapes, the option **Short Ridge On Rectangles** is available, which positions the ridge line along the shorted dimension.

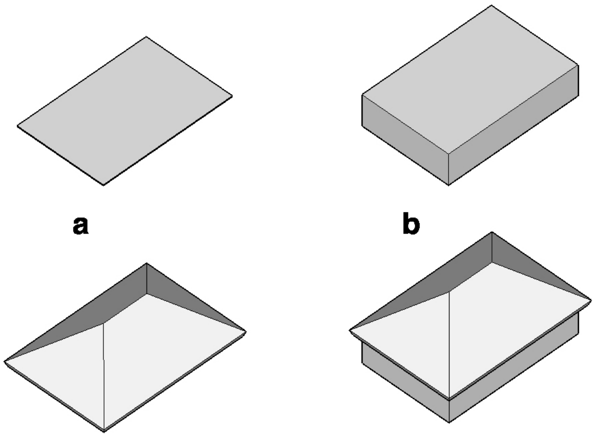
Structure: There are two structural types: **Shell** and **Solid**. The ends (overhangs) of a shell roof may end in three different ways: vertically, diagonally, or horizontally, as shown in the options palette.

Facia Height: The value entered in this field determines how thick the shell of a roof is.

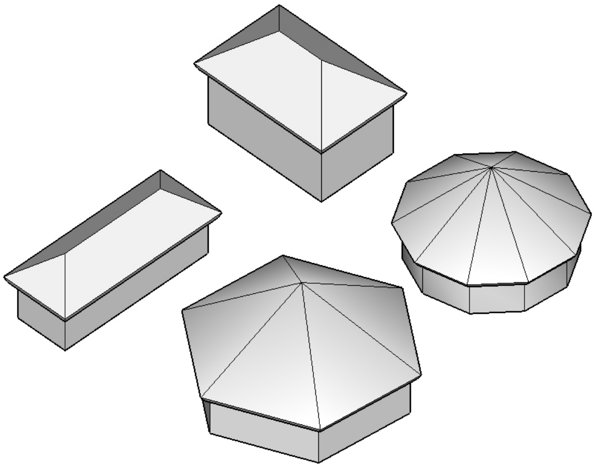
Overhang: The value entered in this field determines whether the original shape picked for the generation of a roof will be extended to produce an overhang. A 0.0 value produces no overhang.

While it typically only makes sense to generate roofs from shapes that lie on a plane parallel to the X-Y orientation, there is no such restrictions and roofs can be generated in any direction.

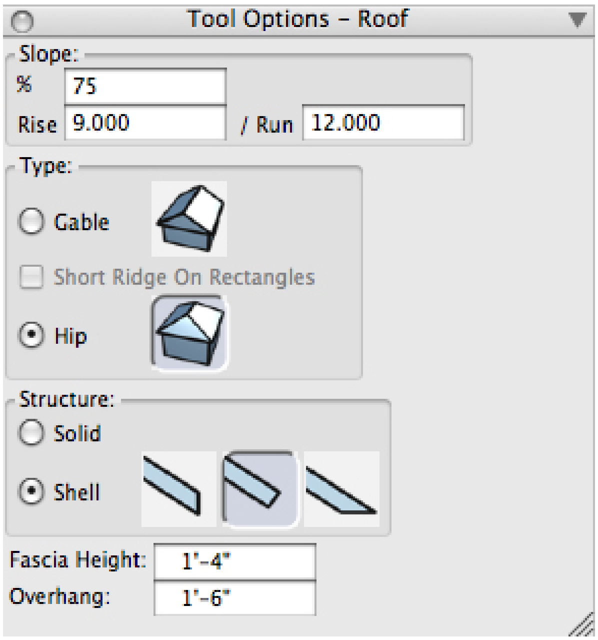
A variety of both simple and more complex roofs are shown below.



Roofs generated from
(a) a 2D shape and
(b) the face of a 3D object.



Prepicking the top faces of four objects results in four roofs generated in one step.



Tool Options – Roof

Slope:

% 75

Rise 9.000 / Run 12.000

Type:

○ Gable

☐ Short Ridge On Rectangles

● Hip

Structure:

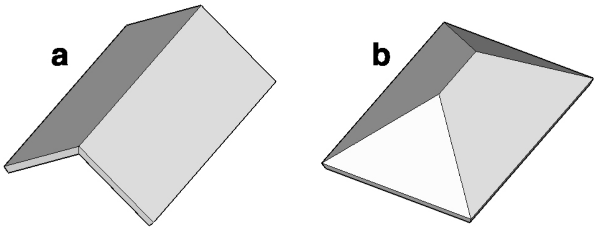
○ Solid

● Shell

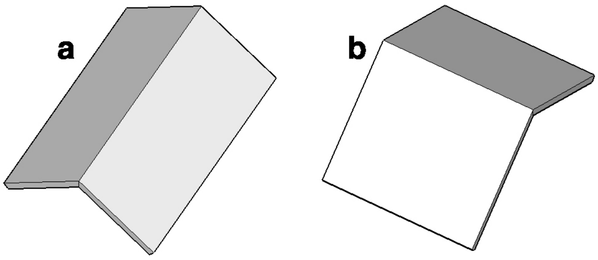
Fascia Height: 1'-4"

Overhang: 1'-6"

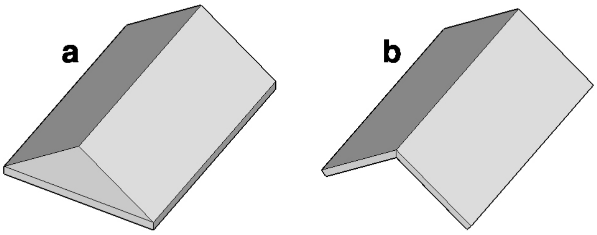
The Roof tool options.



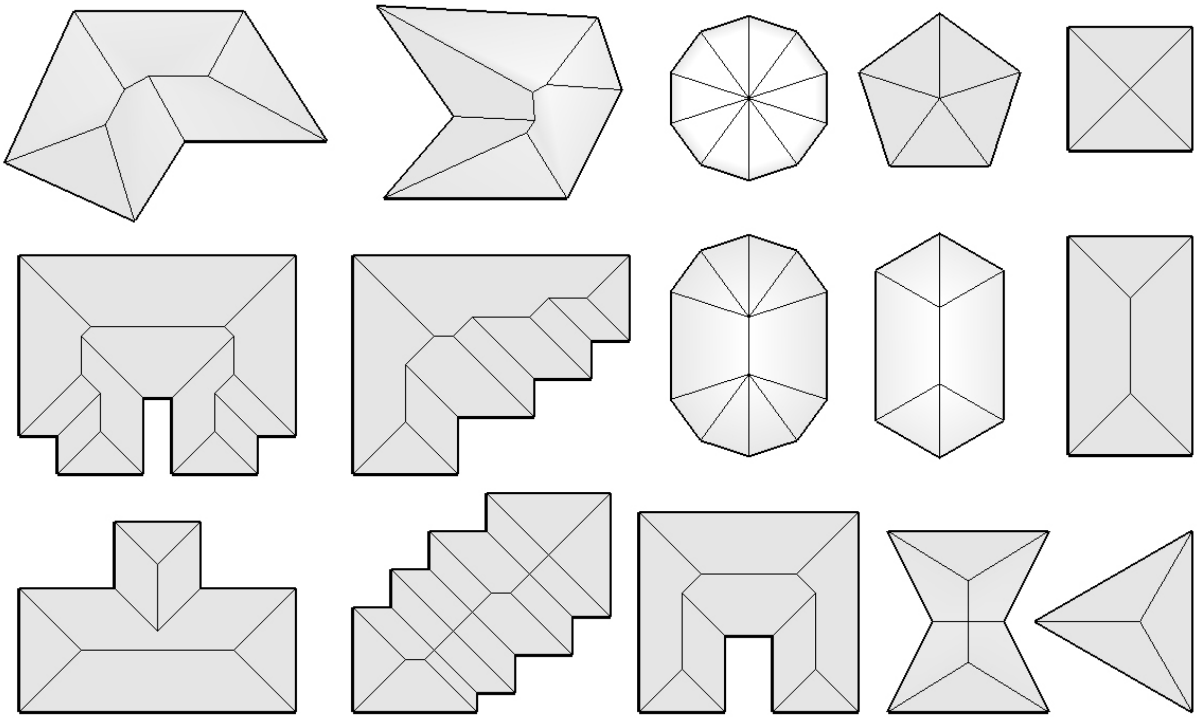
Types of roofs:
(a) Gable and (b) Hip.



Gable roofs with their ridge lines positioned along the
(a) long and (b) short dimensions.



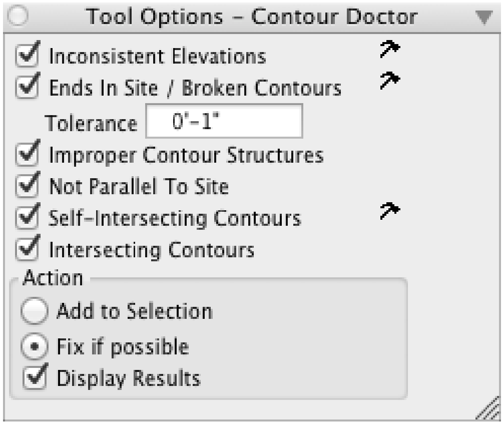
Structures of roofs: (a) Solid and (b) Shell.



A variety of roofs.

Contour Doctor

For the **Terrain Model** tool, discussed next, to be able to generate a model from contour lines, they need to satisfy certain conditions. They should be continuous (not broken), when open they should cross the site line, they should not intersect themselves or each other, and they should be parallel to the plane of the site. If any of these conditions is not satisfied no terrain model will be generated.



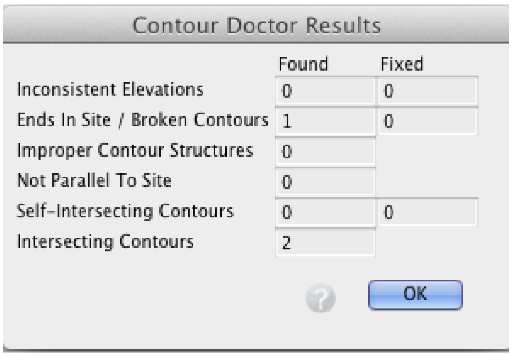
☑ Inconsistent Elevations
☑ Ends In Site / Broken Contours
Tolerance 0'-1"
☑ Improper Contour Structures
☑ Not Parallel To Site
☑ Self-Intersecting Contours
☑ Intersecting Contours

Action
○ Add to Selection
● Fix if possible
☑ Display Results

Contour Doctor Tool Options palette.

The **Contour Doctor** tool can be used to check the conditions of the contours, report problems, if any, and even correct their faults, if possible. To apply the tool, you pick the contour lines and the site as for the **Terrain Model** tool, that is, you pick the contours as a set and then the site.

Which acts will be performed is set in the **Tool Options** palette, which contains a list of six check boxes labeled for the faults that the program can check for. You can choose to check for one, or more of the faults. Note that for the **Ends In Site** condition the **Tolerance** value is significant and should be adjusted according to the scale of your site.



	Found	Fixed
Inconsistent Elevations	0	0
Ends In Site / Broken Contours	1	0
Improper Contour Structures	0	
Not Parallel To Site	0	
Self-Intersecting Contours	0	0
Intersecting Contours	2	

Contour Doctor Results dialog.

The **Action** group of choices instructs the program what to do when faults are uncovered. **Add To Selection** will highlight the problematic contour lines and will exit the operation. **Fix If Possible** will try to correct some of the problems. For example, if broken contours are encountered, the program will connect them, provided their broken parts are within the tolerance. Also, self-intersecting contours will be corrected. However, if a contour intersects another contour, the problem cannot be corrected.

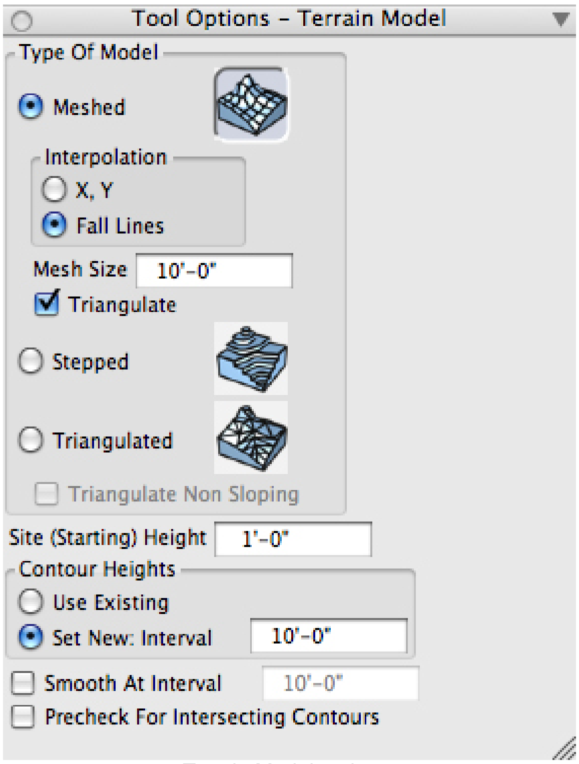
If **Display Results** is also checked, it will present the **Contour Doctor Results** dialog, which shows how many contours were **Found** to be faulty and how many were **Fixed** by category of problems.

Terrain Model

Terrain models can be generated from a set of contour lines and a closed shape that represents the boundary of a site. The contour lines can be vector lines or splines, open or closed, laid out in a manner that makes topographical sense. For example, they cannot intersect. Open contour lines should be crossing the site boundaries. They may have a height value (Z is not 0) or they may all lie flat on the ground, in which case we need to instruct the **Terrain Model** tool to generate heights for them before they are used for the generation of a terrain model.

To derive a terrain model, with the **Terrain Model** tool active and while pressing the ***shift*** key, click on the contour lines, in the order heights need to be assigned to them. If they already have heights, the order is insignificant. After ***shift***-picking the last contour, release ***shift*** and click anywhere in the project window, then, with the **Terrain Model** tool still active, click on the site. The terrain model is generated immediately. The type of terrain model or it's numeric values may be altered while the new terrain model is highlighted in orange directly after clicking the site boundary. When the result is satisfactory, the operation can be completed by clicking a tool icon to go on to the next tool operation.

There are three types of terrain models, which can be selected from the **Terrain Model Tool Options** palette.



Tool Options – Terrain Model

Type Of Model
● Meshed
Interpolation
○ X, Y
● Fall Lines
Mesh Size 10'-0"
☑ Triangulate
○ Stepped
○ Triangulated
☐ Triangulate Non Sloping

Site (Starting) Height 1'-0"

Contour Heights
○ Use Existing
● Set New: Interval 10'-0"

☐ Smooth At Interval 10'-0"
☐ Precheck For Intersecting Contours

Terrain Model options.

Meshed: The site surface is meshed and then the heights of its points are adjusted according to the heights of the contour lines. The latter is done through interpolation, which may be more or less accurate, depending on the option selected from the Interpolation pop-up menu. The density of the mesh depends on the value entered for Mesh Size. Turning on **Triangulate** produces a triangulated mesh, which is a variation of the plain mesh.

Stepped: The contour lines are inserted to the site and then extruded according to their heights.

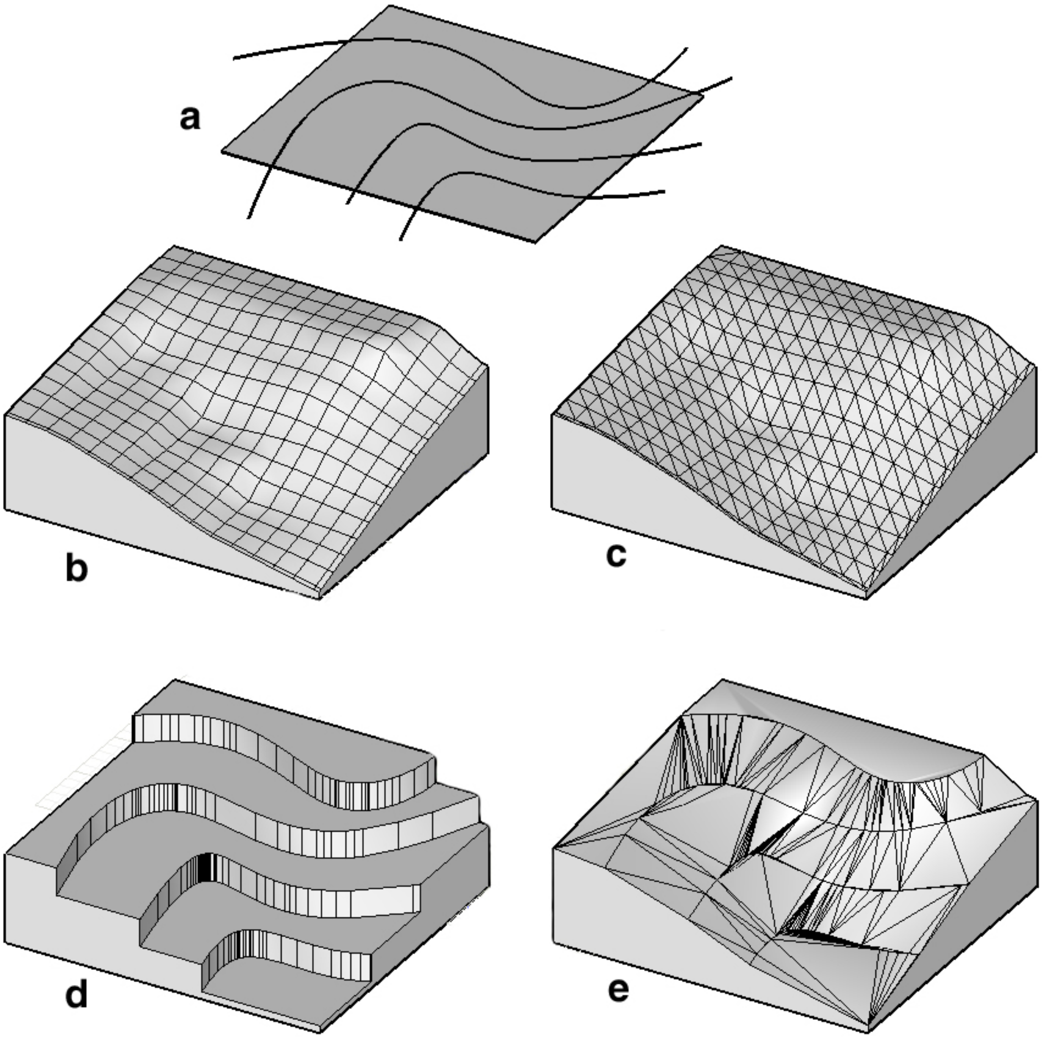
Triangulated: The contours are again inserted in the site, but are not extruded. After they are positioned to the appropriate heights, the non-planar surfaces between them are triangulated.

Site (Starting) Height: The value in this field specifies the lowest elevation of the terrain model, which becomes the basis for the other elevations.

Contour Heights: There are two options in this group: **Use Existing** and **Set New**. The former is used when the contour lines already have heights. The latter when heights need to be assigned, which is done using the value in the **Interval** field.

Smooth At Interval: This option applies only when the contours are vector lines, rather than splines, which are already smooth. When on, the vector lines are rounded. This option only impacts the stepped and triangulated terrain types. It has no effect on the meshed models.

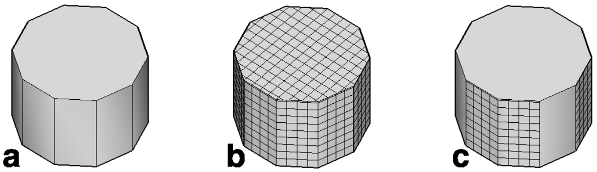
Precheck For Intersecting Contours: As already mentioned, the contours being horizontal slices of landforms, generally make no sense to intersect each other. Intersecting contours are not accepted by the stepped and triangulated types, which will fail when the condition is encountered. This option instructs the program to check the contours before any attempt is made to generate a 3D model.



Terrain Model options:
(a) Set of contour lines and site. Terrain model types: (b) meshed,
(c) triangulated mesh, (d) stepped, and (e) triangulated contours.

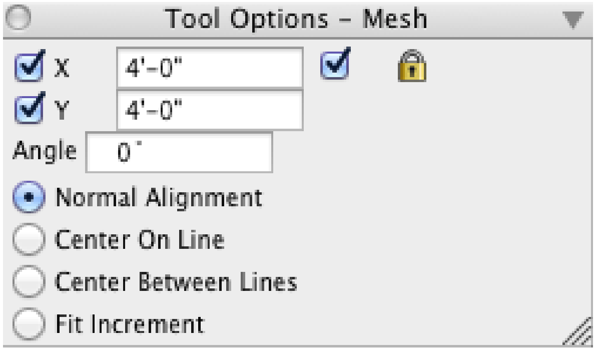
Mesh

This tool is used to generate a rectangular mesh to either all or selected faces of an object. To apply it, with the tool active, click on an object, which meshes the whole object. Or, to mesh a face individually, apply the operation as above, but use the ***tab*** key to select the face you wish to mesh. See examples of both. The prepick method can also be used to mesh more than one face in one step.



(a) Original object,
(b) whole object meshed, and
(c) selected faces meshed.

The size of the mesh is determined by **X** and **Y** parameters in the **Mesh Tool Options** palette. When the lock option is on they are constrained to the same value.



Tool Options - Mesh

☑ X 4'-0" ☑

☑ Y 4'-0"

Angle 0°

● Normal Alignment

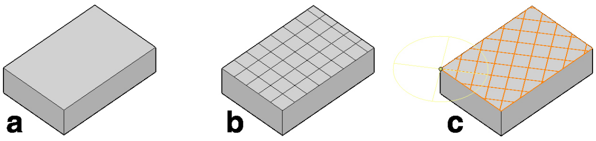
○ Center On Line

○ Center Between Lines

○ Fit Increment

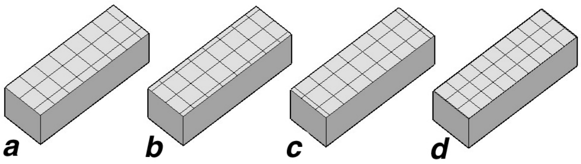
The Mesh tool options palette.

When a complete object is meshed, the direction of the mesh is determined by the program. When applied to a single face, after the initial generation of a mesh, the user has the opportunity to move it and to rotate its direction through a circular control that appears as soon as the mesh is generated. The orientation of the mesh can also be set by entering a value in the **Angle** field. See illustration.



(a) Original object,(b) default mesh direction, and (c) mesh after rotation.

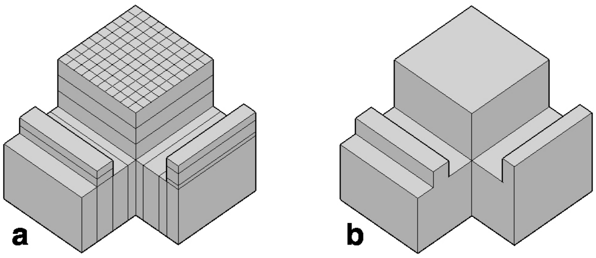
Four options in the tool palette affect the positioning of the mesh. **Normal Alignment** does no adjustment. **Center On Line** places a mesh line at the center of a face and then arranges the mesh on both sides. **Center Between Lines** places the center of a tile at the center of a face. **Fit Increment** adjusts the given tile sizes so that only complete tiles are generated.



(a) Normal Alignment, (b) Center On Line, (c) Center Between Lines, and (d) Fit Increment.

Unmesh

This tool does the opposite of **Mesh**. It merges coplanar faces that share an edge, which effectively cancels a mesh. To apply it, with the tool active, click on a meshed object or face. The result appears immediately. See example. If applied to a non-meshed object, this operation has no effect. This operation can also be applied by picking two or more faces that have common edges.

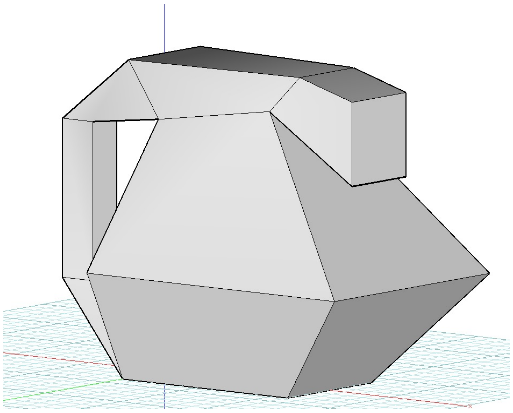


(a) Original meshed object and
(b) after Unmesh tool applied.

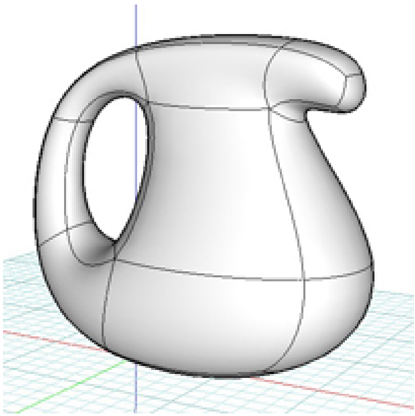
Subdivision Surfaces

Subdivision Surface modeling is a technique that takes a simplified “cage” mesh (a standard facetted object that has had subdivision applied) and subdivides the existing polygons to create a smoother derivative surface. The relative distances between vertices and segments in the facetted cage directly control the shape of the subdivision.

Subdivision surfaces enable the modeling of complex smooth surfaces with simple, low-vertex meshes, allowing smooth, organic, high-resolution mesh modeling derived from simple geometry. The subdivision technique can be used to add detail to an object, or to smooth it out.

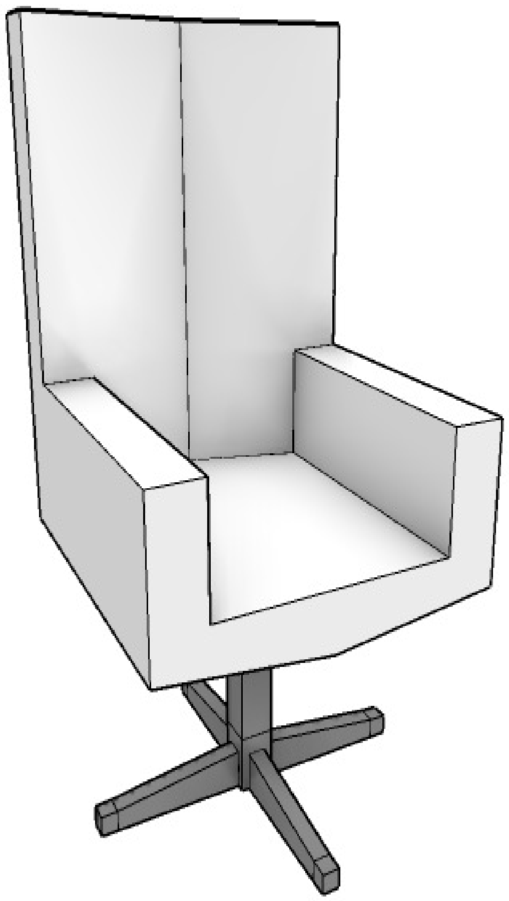


The facetted version of a pitcher model, or “cage", prior to clicking on it with the Subdivision Create Tool.

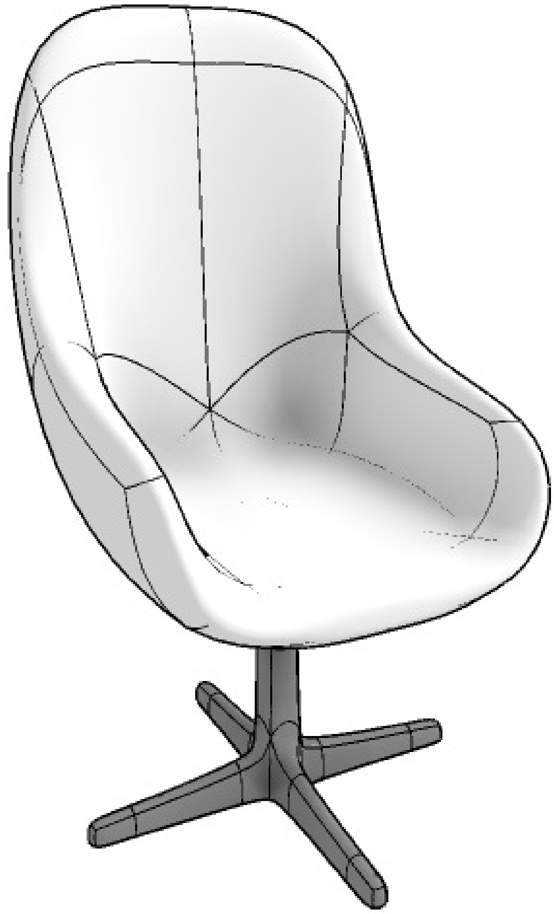


The Subdivision version of the model.

Subdivision surfaces get their name from their characteristic: “dividing into regions of greater detail”. This modeling technique begins with a base mesh and divides and subdivides regions into finer detail, with each subdivision giving greater control in that area. That is, a region of a surface that has a complex shape can have more control points to allow finer detail, while a more simple or flat region will have fewer control points. The **form•Z** subdivision system is based on the Catmull-Clark algorithm [Catmull and Clark 1978]. At each increasing level of subdivision, each face gets split into four new faces. For this reason and others, one important aspect of good subdivision modeling is the construction and maintenance of a polygonal structure that is made up of polygons that are four sided. The subdivision tools in many case help to preserve an underlying "quad" mesh. This allows the subdivision operations to have predictable results when dividing, or adding new faces.



The facetted version of a chair model, or "cage", prior to clicking on it with the Subdivision Create Tool.

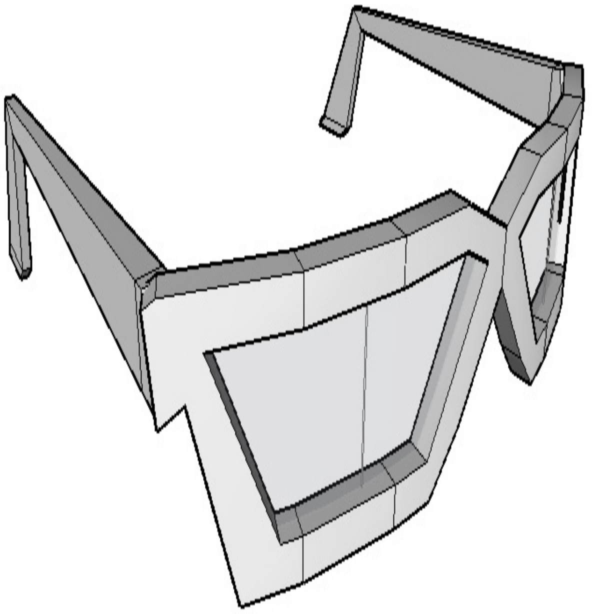


The Subdivision version of the model.

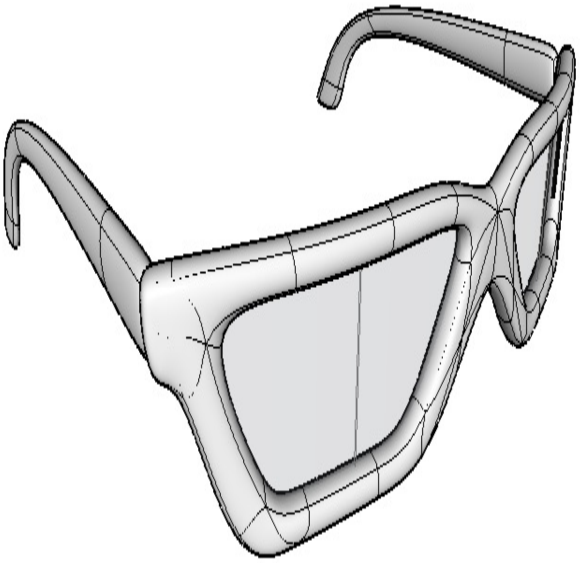
Advantages of subdivision surfaces

There are several advantages to using **Subdivision Surfaces** for modeling:

1. Subdivision surfaces allow higher level of control over form than polygons.
2. Allows for the use of complex geometry only in complex regions of a model.
3. Allows creases (sharp edges) in conjunction with smooth and flowing surfaces.

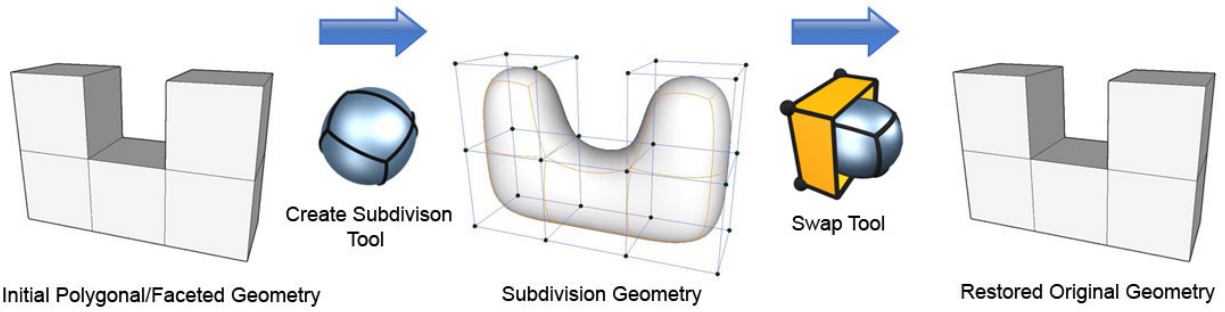


The facetted representation of a pair of sunglasses, prior to using the Subdivision Create tool on the parts.



The Subdivision version of the same geometry.

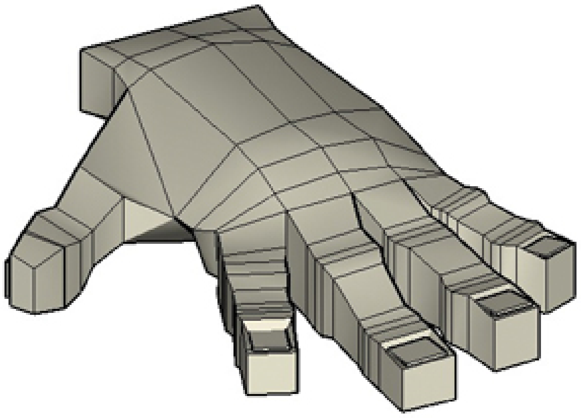
To work with **Subdivision** surfaces, first create a polygon/facetted object, called a cage, that roughly captures the basic shape of the model you wish to build. Try to construct it so that its polygonal structure is entirely (or primarily) made up of four-sided faces. This model will determine the base topology and the locations of control points on the resulting surface when you convert it to a subdivision surface. Each segment will be a subdivision edge, and each point will become a subdivision control point. As you work on the model, you can convert freely between the subdivision surface and the underlying polygonal "cage" geometry. Use the **Swap** tool to go back and forth rapidly between the polygonal geometry, and the subdivision surface. This can be quickly done by assigning a key shortcut, so simply tapping a key will make the change occur.


Create Subdivison Tool
Swap Tool
Initial Polygonal/Faceted Geometry
Subdivision Geometry
Restored Original Geometry

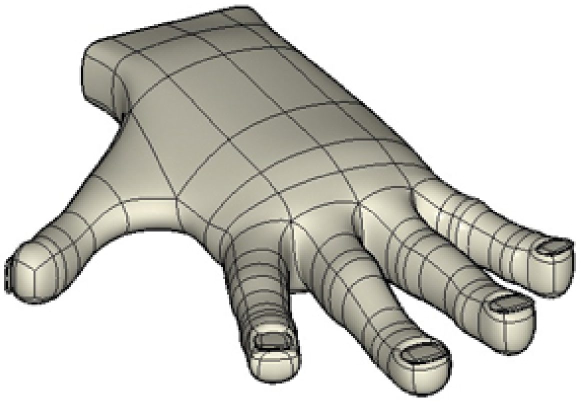
After you convert the polygonal mesh to a subdivision surface, you can adjust the shape of the subdivision surface by moving the control points when the controls are showing, or by using the **Transform** tools on the points, segments, and faces of the surface itself. You'll find you can use many of the existing **form•Z** tools to edit the object, or you can use the subdivision specific tools. Some modeling tools will work better in the facetted mode, and others will work better in subdivision mode. By toggling back and forth between the states, you can utilize the power of both modeling toolsets.

If you need more control in a particular region of a subdivision mesh, you can select those faces and create a new subdivision level with the **Divide** tool. If you want to apply a sharp edge to a region of the surface you can apply either a full or partial crease to a subdivision object, face, or segment.

A **Cage** is a facetted object that essentially is the object before subdivision, which becomes the controlled object after it has been sub-divided. You can also **Show Controls** on subdivision objects in the same way that you can with other parametric objects in **form•Z**. These controls can be on or off, as with any other controlled object, (F6) can be used to toggle the visibility of these controls. The subdivision tools will operate directly on showing control lines as well as faces, segments, and points. It is not neccessary to hold down ***cmd*** (OS X) or ***ctrl*** (Windows) when applying the subdivision tools at the sub-object level when the controls are showing, but it is required when they are not.



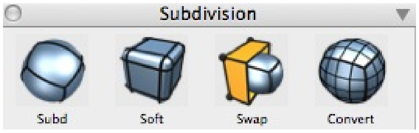
Initial Polygonal/Facetted or "cage" geometry prior to clicking on it with the Subdivision Create tool.



Subdivided or "Subdivision" Geometry.

Subdivision Surface Tools

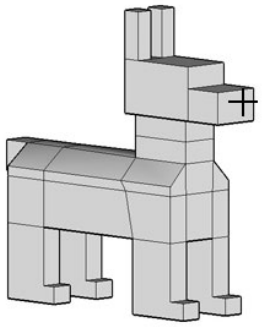
The **Subdivision** tools are for converting facetted objects into subdivision surfaces or vice-versa, or subdivision surfaces into NURBS, or quad meshes. This row contains four tools, **Subdivision Create**, **Soften**, **Swap**, and **Convert**.



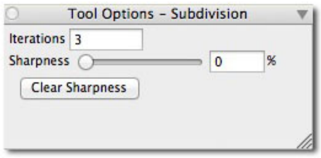
The Subdivision Surface tools.

Subdivision Create

Clicking with this tool on a 3D polygonal object (cage) smooths it by applying a subdivision process. Subdivision is applied at the object level.

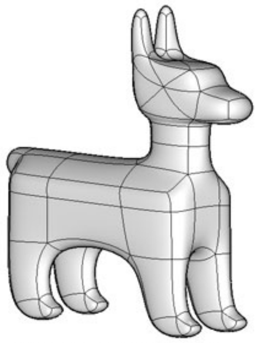


Clicking on a polygonal/facetted object.



Iterations 3

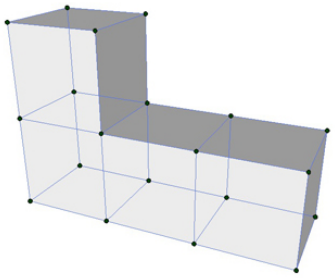
Sharpness 0 %



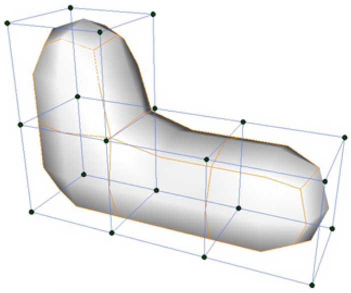
New subdivision object.

The **Subdivision** operation itself is controlled by the following options, set in the **Tool Palette**:

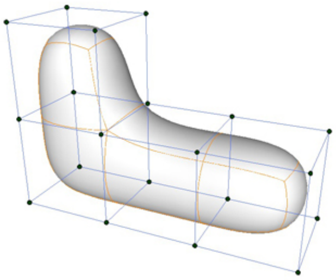
Iterations: In this numeric field you enter the number of subdivision smoothing iterations that will be applied to the object. Each iteration generates all polygons using the vertices created from the previous iteration. By default, the subdivision level is set to 3. If you need to have a higher level of detail you should change the value to a higher value. How detailed the subdivided surface is depends on how many times it has been subdivided. Higher levels of iterations can decrease performance.



Subdivision Iterations = 0



Subdivision Iterations = 1

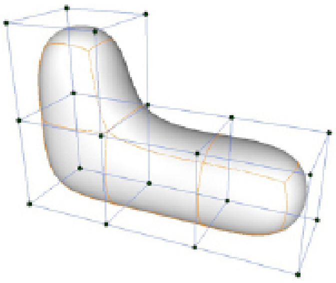


Subdivision Iterations = 3 (default)

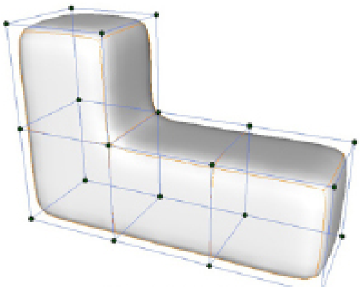
Sharpness: This slider appears in the **Tool Options** palette after you have shown the picked object's controls. The value is set by default to 0, which creates no **Sharpness**. After the initial generation of the subdivision, you can drag the slider to a different position which affects the magnitude of the **Sharpness**. This can be applied to a complete object, or to sub-parts of the object such as points, edges, and faces. Note that these need to be pre-picked before the slider is manipulated. Parts of objects are selected from the controls when they are showing.

A previously subdivided object can be visited again and its parameters further manipulated. This is done by invoking the **Create Subdivision** tool again and clicking on the previously sub-divided object. This invokes its options palette again and makes available its parameters to be further manipulated.

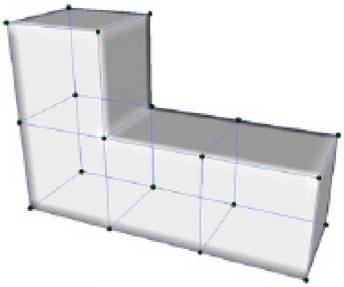
Examples of the **Sharpness** feature in action are shown below:



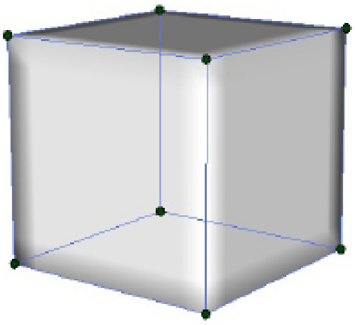
Sharpness = 0



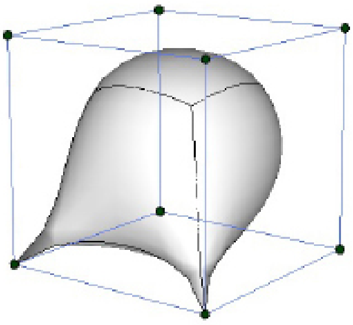
Sharpness = 50



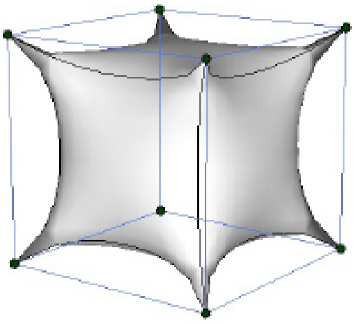
Sharpness = 100



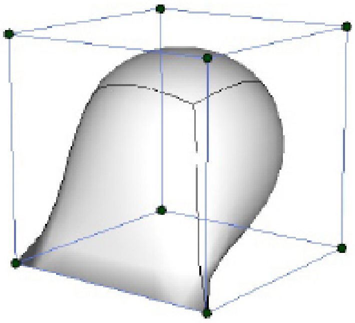
Sharpness applied to the entire object.



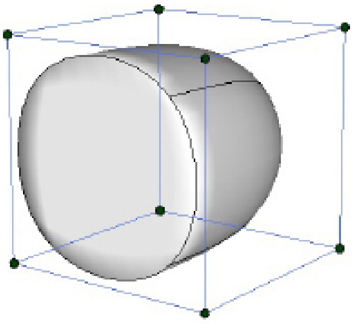
Sharpness applied to only two points.



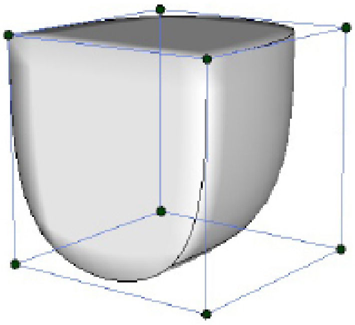
Sharpness applied to all points.



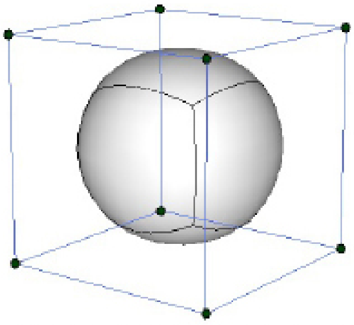
Sharpness applied to only one segment.



Sharpness applied to only one face.



Sharpness applied to only two faces.



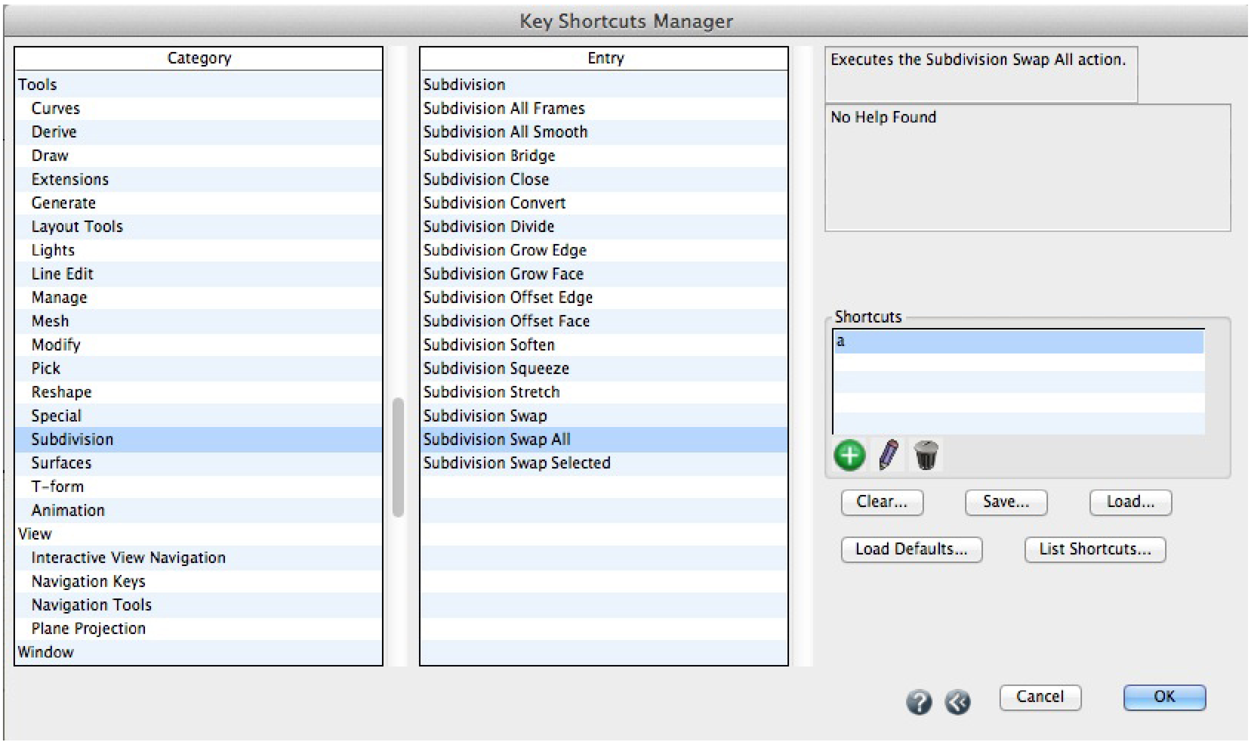
Sharpness cleared, object not Sharpened.

Clear Sharpness: Clicking on this button returns an object to 0 Sharpness, that is, it's default sharpness.

Subdivision Swap

This tool quickly toggles between the subdivision state and the underlying "facetted state", or cage. You can do this with either currently selected objects, or with all qualifying objects in a project. You can assign a key shortcuts to each method of this tools operation:

> **Subdivision Swap**: This key shortcut when assigned, will select the **Swap** tool, as though you have just clicked on the tool's icon in the **Subdivision** palette.
>
> **Subdivision Swap All**: This key shortcut when assigned will toggle the subdivision state of all objects in the file, whether selected or not. This key shortcut acts as a toggle, hitting the key again will reverse the states of all the objects that have been subdivided.
>
> **Subdivision Swap Selected**: This key shortcut when assigned will toggle the subdivision state only for picked objects. This key shortcut acts as a toggle, hitting the key again will reverse the states of all the objects that have been subdivided *and selected*.
>
> **Subdivision Swap All Frames**: This key shortcut when assigned converts all subdivision objects that are in their subdivided state to their facetted state. This is useful for unifying the state of all subdivison objects in a project.
>
> **Subdivision Swap All Smooth**: This key shortcut when assigned, converts all subdivision objects that are in their facetted state to their subdivision state. This is useful for unifying the state of all subdivison objects in a project.



Executes the Subdivision Swap All action.

No Help Found

Shortcuts: a

The Key Shortcuts Manager showing the Subdivision category, with the "Subdivision Swap All" entry set to the "a" key.

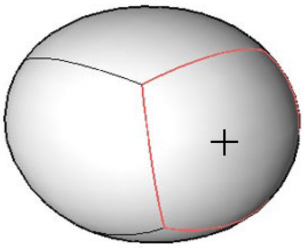
Grow Face

This tool grows or extrudes new geometry from a clicked face on a subdivision surface to a predefined distance in a direction perpendicular to the picked entity. After the grow is executed, and while the grown selection is in the result buffer, **Distance** and **Angle** widget controllers appear to allow this distance and angle to be modified graphically. These values can also be unlocked or have values numerically entered in the **Tool Options** palette.

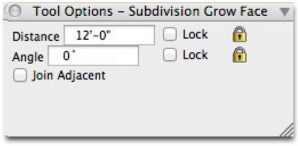
Distance: This is the value or magnitude in project units that the face will be grown. This value can be locked so it can be repeatedly applied in a uniform way to any number of faces.

Angle: This is the angle in degrees or direction that the new face will grow in. This value can be locked so it can be repeatedly applied in a uniform way to any number of faces.

Join Adjacent: This option will treat a series of pre-picked faces as if they are continuous. Without this option checked, they are grown individually.



Clicking on a Sub-D face with the Grow tool.

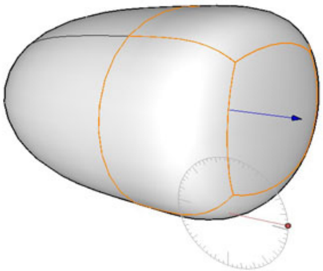


Tool Options – Subdivision Grow Face

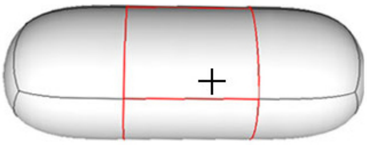
Distance 12'-0" ☐ Lock

Angle 0° ☐ Lock

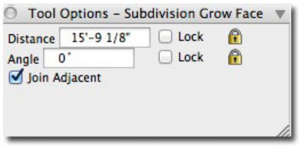
☐ Join Adjacent



Face "Grown" with Angle and Distance controls active.



A Series of Faces Pre-picked with the Grow Face tool with the Join Adjacent Option Checked.

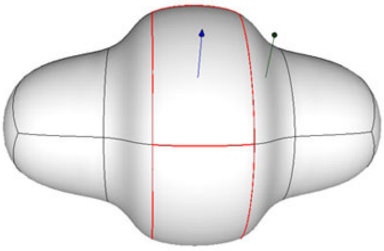


Tool Options – Subdivision Grow Face

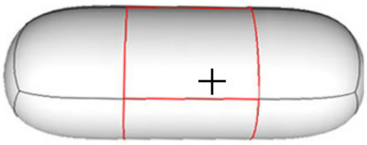
Distance 15'-9 1/8" ☐ Lock

Angle 0° ☐ Lock

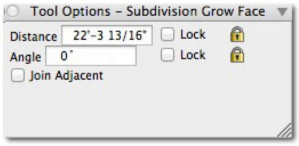
☑ Join Adjacent



Faces selected are "Grown" with Angle and Distance controls active.



A Series of Faces Pre-picked with the Grow Face tool without the Join Adjacent Option Checked.

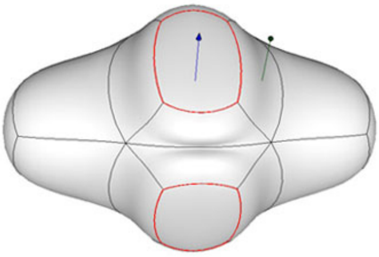


Tool Options – Subdivision Grow Face

Distance 22'-3 13/16" ☐ Lock

Angle 0° ☐ Lock

☐ Join Adjacent



Faces selected are "Grown" separately with Angle and Distance controls active.

Right-Click Context Menu for Subdivision Surfaces

When right-clicking upon a subdivision object (the controls must be showing) you will be presented with five options: **Delete**, **Remove**, **Select Sequence**, **Insert Sequence**, and **Show Controls**.

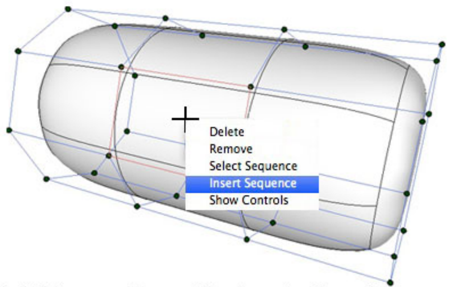
Delete: Removes a point, segment, or face and rebuilds the object instantly without it. This will not result in an open shape.

Remove: Deletes a point, segment, or face, but doesn't rebuild the object without them. This will create an open object with missing faces or "holes".

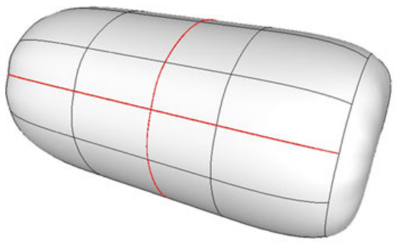
Select Sequence: Allows easy selection of adjacent edges, and will select all adjacent segments.

Insert Sequence: Adds rows of edges to subdivision surfaces. It will complete a circuit around a model if there are faces that align within the tolerance allowed. It will place the new sequence as closely as possible to the click point on the segment.

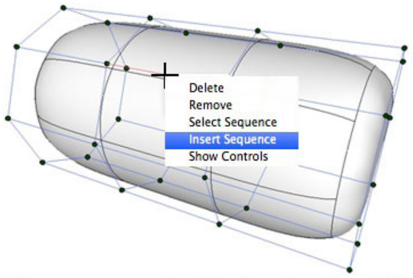
Show Controls: Toggles the visibility of the controls, this is the same function as pressing F6.



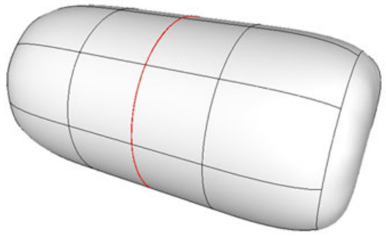
Right-clicking on a face while choosing "Insert Sequence" in order to insert new sequences going in both directions.



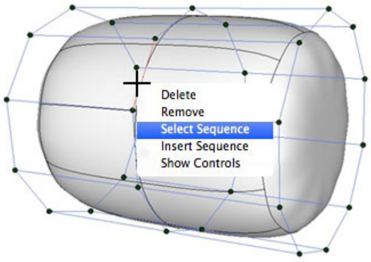
The two new sequences highlighted, one going in each direction.



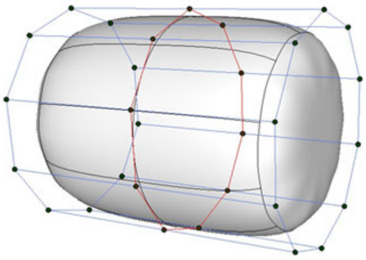
Right-clicking on a segment while choosing "Insert Sequence" in order to insert a new sequence going in one direction.



The new single sequence highlighted, created in the perpendicular direction to the clicked segment.



Right-clicking on a segment and choosing "Select Sequence".



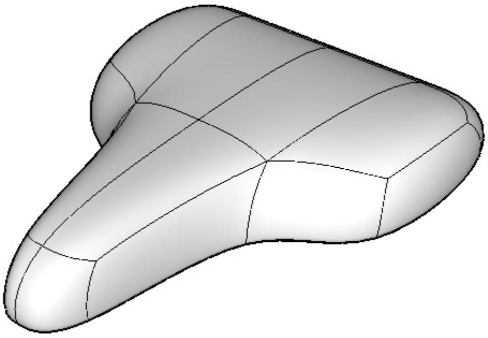
The sequence selected.

Subdivision Modeling Tutorials

The followng tutorials will get you started using the subdivision tools, and describes how you will start with a facetted object, convert it to a subdivision object, and then use the **Subdivision Edit** tools to further modify the form.

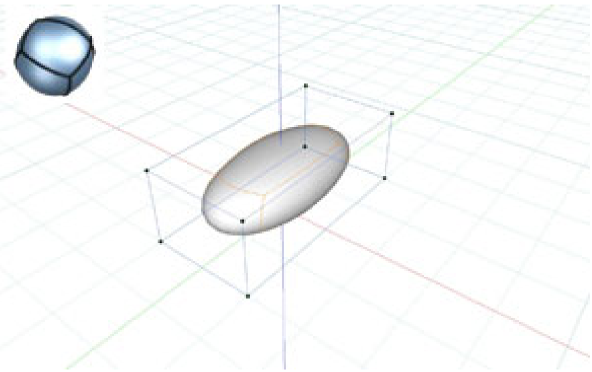
Subdivision Bike Seat Tutorial

Here is a very basic subdivision bike seat. This step-by-step tutorial will touch upon several important aspects of subdivision modeling. You can follow along in **form•Z** as you read the numbered steps and study the figures at right.

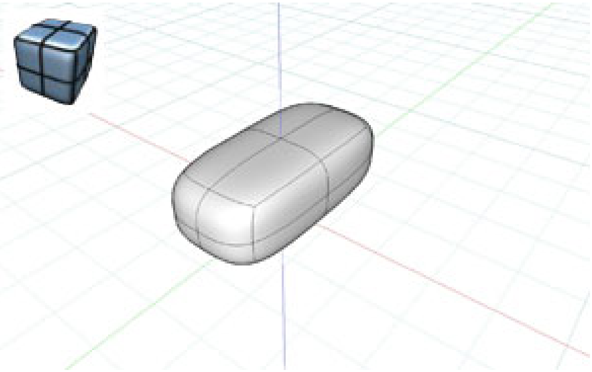


1. Begin in a 3d view, and draw a **Rectangle** on the reference plane with the **Extrusion** modifier selected by clicking to define the two bottom corners and then pulling it up as shown to complete the operation, creating a 3D box shape.
2. Using the **Subdivision Create** tool, click on the object to make it into a subdivision object.

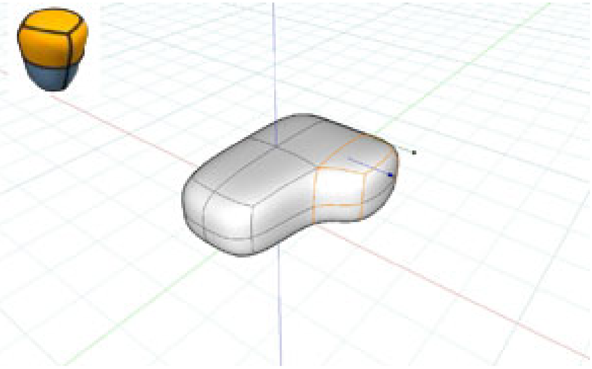
file_menu.tiff



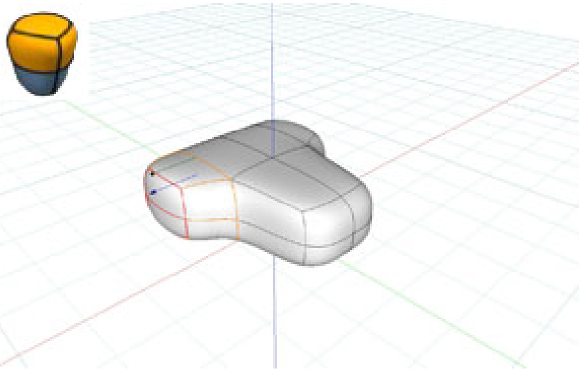
3. Using the **Divide** tool, click once on the object. This creates four faces for every single face on the object, quadrupling the number of subdivision faces.



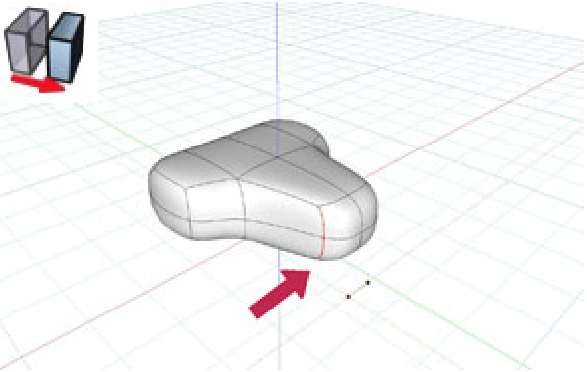
4. Use the **Grow F(ace)** tool with **Join Adjacent** checked to grow the two back faces on the side as shown. Hold down shift and then click both faces with the tool. Release the key and click in the window. The **Angle** value should be 0.



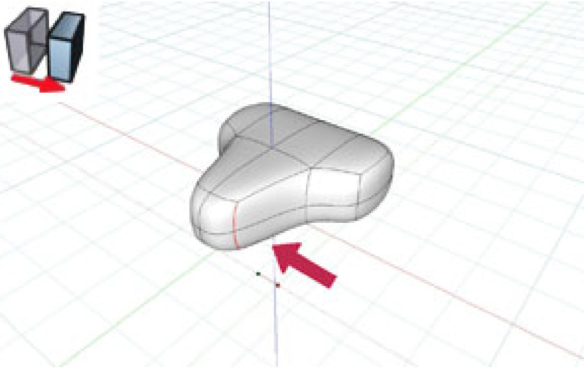
5. Repeat the same procedure for the two faces on the opposite side. The last values used are the ones used upon subsequent uses of the tool. This makes it easy to grow different faces by the same distance and angle.



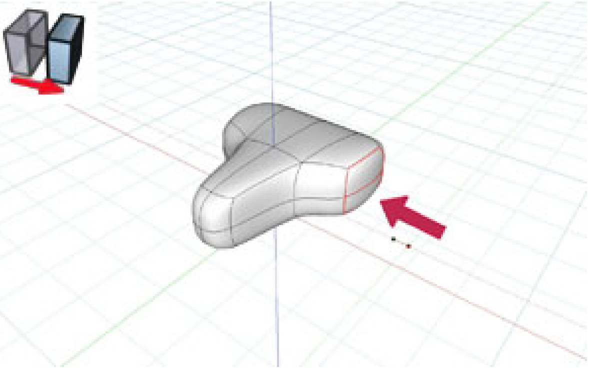
6. Use the **Move** tool to pre-pick two of the segments at the front side of the object as shown. Hold down cmd(OSX)/ctrl(Windows) and shift and then click both segments with the tool, then release the keys and click in the project window to start the move. Click to complete.



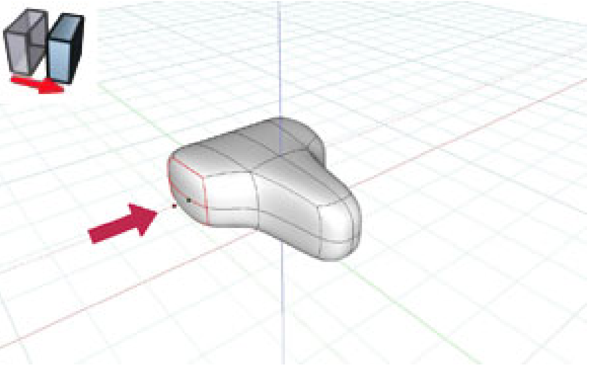
7. Repeat the same procedure for the other side.



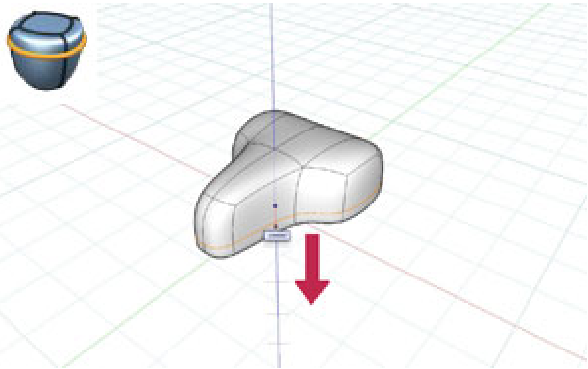
8. Use the **Move** tool again, this time clicking on the two rear side faces as you hold down cmd(OSX)/ctrl(Windows) and shift as shown. After both faces have been selected, release the keys, and click in the project window and drag the faces along the temporary guide.



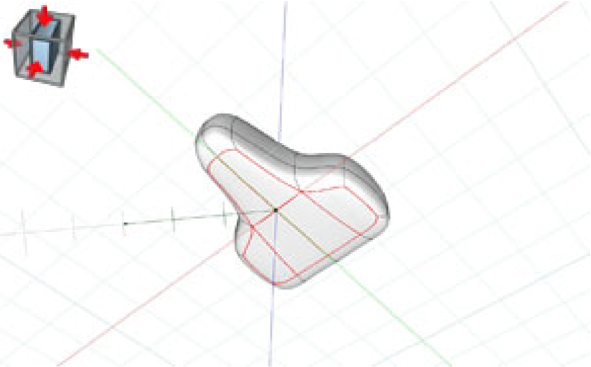
9. Repeat the same procedure on the other side of the object.



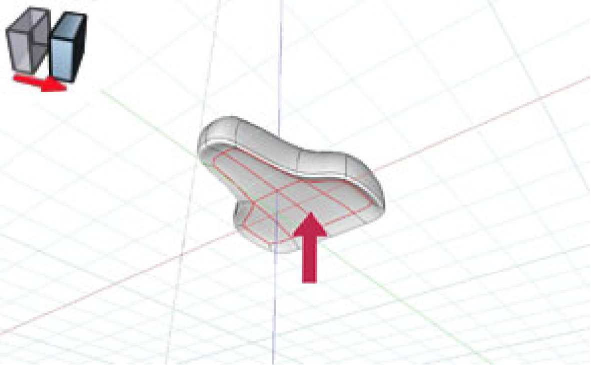
10. Use the **Offset E(dge)** tool with the **Sequence** option checked, and click and drag the sequence that goes around the seat downward.



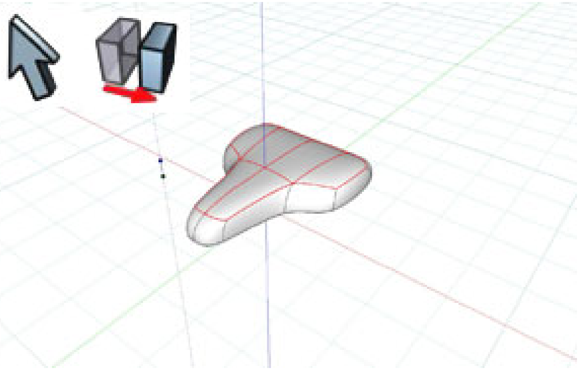
11. Use the **Uniform** scale tool, and by holding down cmd(OSX)/ctrl(Windows) and shift, pre-select the faces shown, release the keys, and then click in the project window to begin dragging to scale down the faces on the bottom of the seat as shown. We do this so we can push them up into the bottom of the seat in the next step.



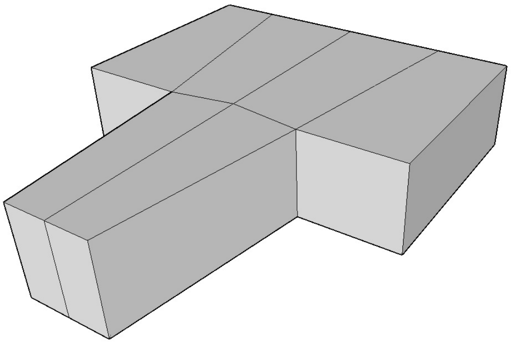
12. Use the **Move** tool to move the same selection upward, making the underside and the curved edge at the bottom of the seat.



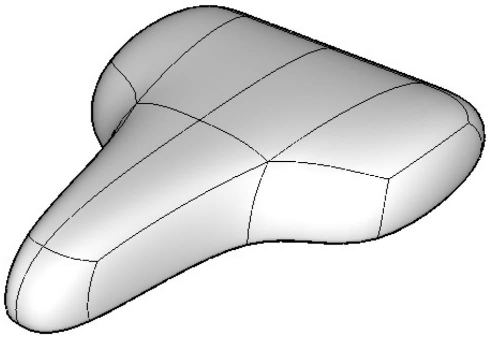
13. Use the **Pick** tool and click in the project window to clear the selection. Get the **Move** tool again, and by holding down cmd(OSX)/ctrl(Windows) an shift, pre-pick the top faces, release the keys, and click in the project window and drag to move them down.



The complete bike seat is below.



The facetted version of the bike seat model, or “cage”.

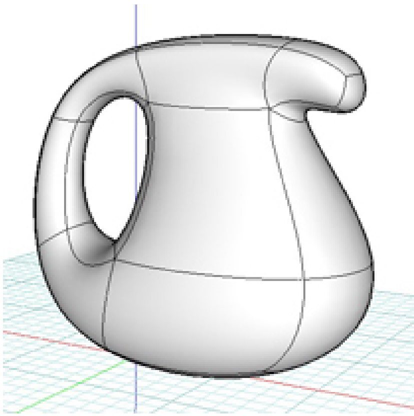


The Subdivision version of the model.

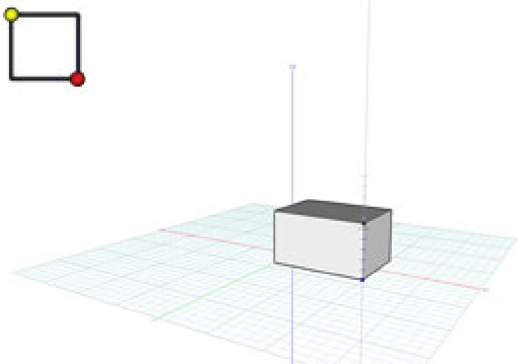
Subdivision Water Pitcher Tutorial

Here is a very basic Water Pitcher shaped object. This step-by-step tutorial will touch upon several important aspects of subdivision modeling.

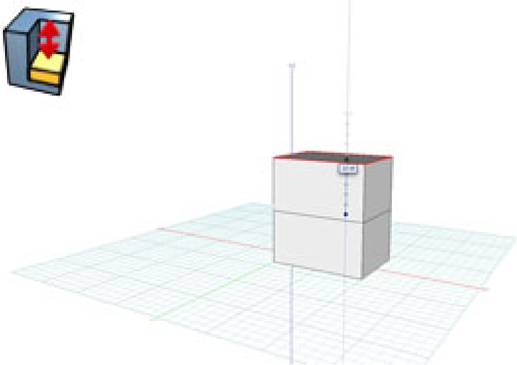
Note: If you are already familiar with **form•Z**, you may skip to step 6 by creating geometry that matches that figure, if not, you should start with step 1 so that your pitcher will have similar proportions to the one shown.



1. Begin in a 3d view, and draw a **Rectangle** on the reference plane with the **Extrusion** modifier selected by clicking to define the two bottom corners and then pulling it up as shown to complete the operation, creating a 3D box shape.

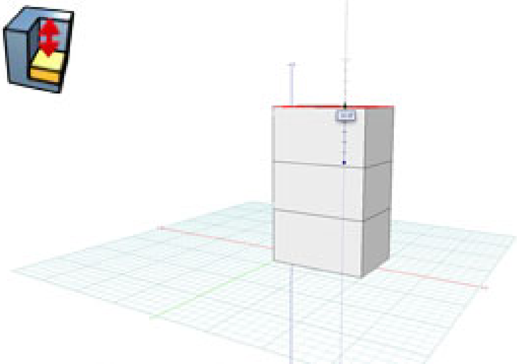


2. Using the **Reshape** tool with the **Keep Edges** option checked, click on the top face, and pull it up by about the same distance. Using the **Keep Edges** option works well for creating cage meshes.

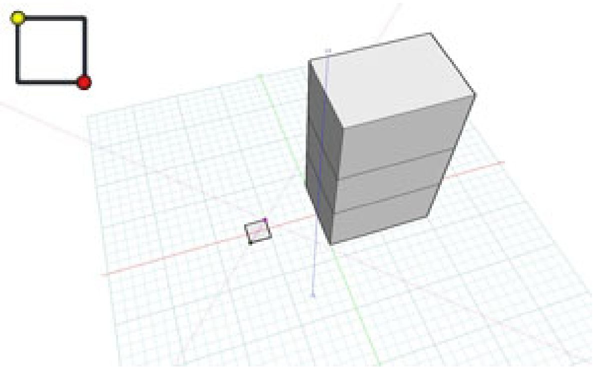


3. Continuing to use the **Reshape** tool, click the new top face and drag this up by a comparable distance.

This will be the main body of the pitcher.

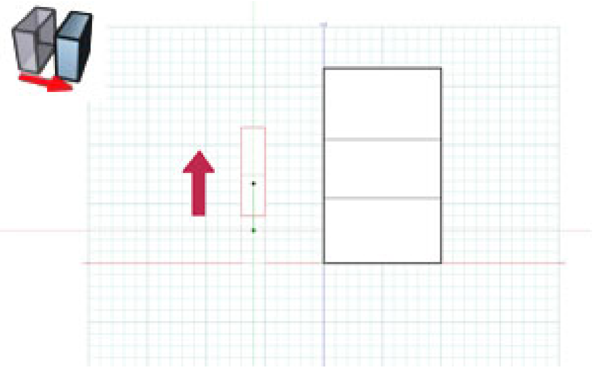


4. Change your view with the **Set View** tool, and draw another box, this time starting by drawing a square on the reference plane as shown.

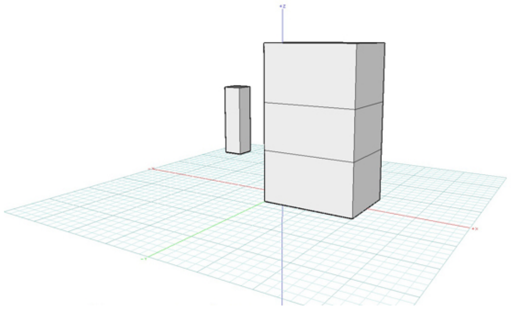


5. Switch to a side view, and use the **Move** tool to move the smaller object up a bit.

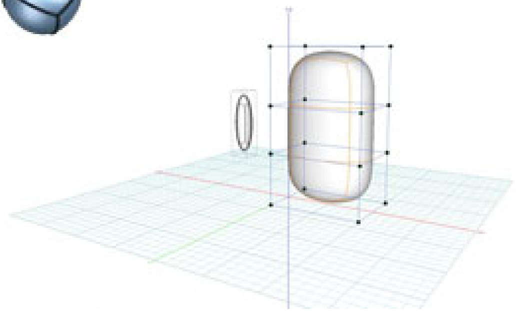
This will become the handle of the pitcher.



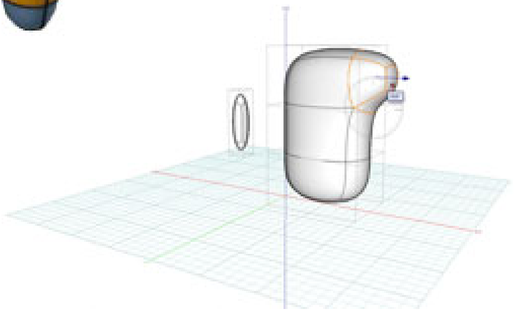
6. Switch to 3d View. Now we have everything we need to convert our objects into subdivision surface models and complete the pitcher.



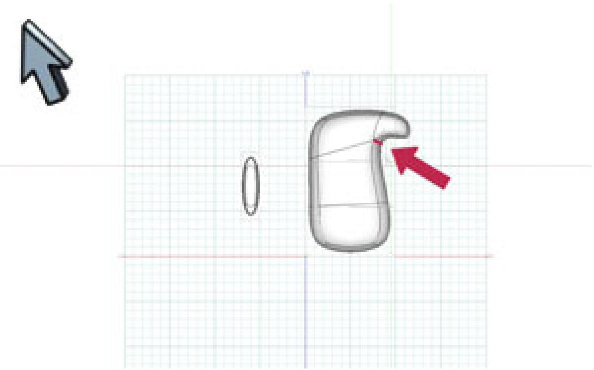
7. Click on both objects with the **Subdivision** tool. Click back on the Pick tool to hide the control points for now. Many of **form•Z's** standard tools work directly on topological level of subdivision geometry just as they do on facetted or smooth models.



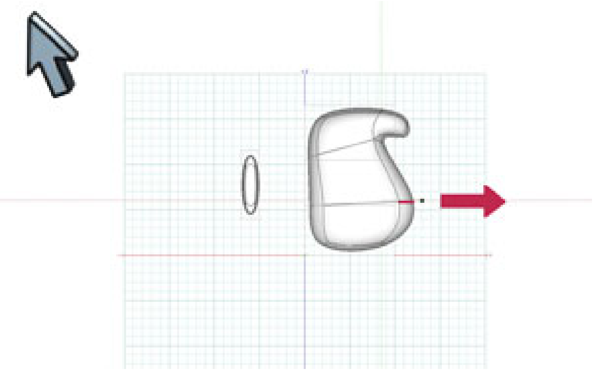
8. Use the **Grow F(ace)** tool to click on the top front face as shown and use the widget controls to shape it until it matches the figure.



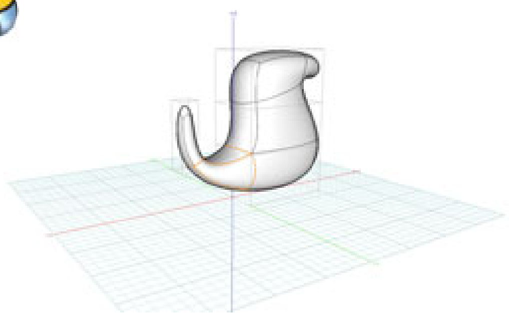
9. Switch to a side view, and with the **Pick** tool set to **Segments**, click and drag the segment shown upward and in towards the center line of the pitcher, to create more of a spout shape.



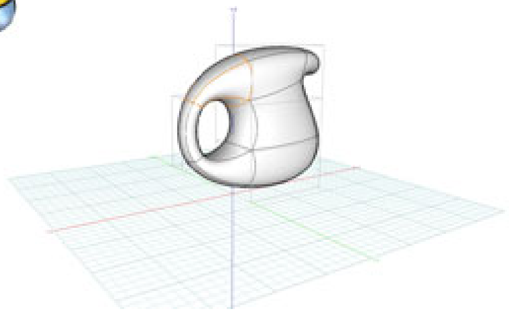
10. With the **Pick** tool set to **Segments**, click and drag the segment shown away from the imaginary center line of the pitcher, to make the belly area larger.



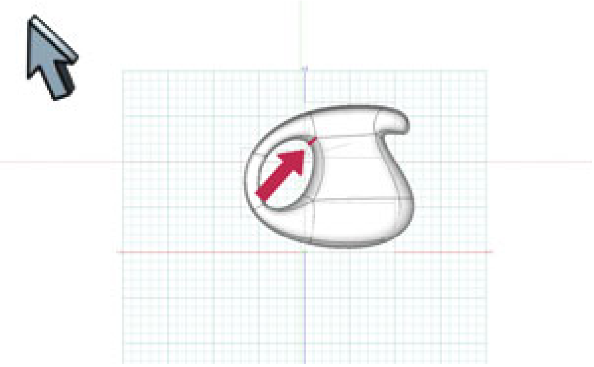
11. In a 3d view, use the **Bridge** tool to click on faces near the bottom, as shown. The edges you click near while selecting faces determine the orientation of the bridge. Use the **Twist** parameter in the **Tool Options** to change the orientation if it is not correct.



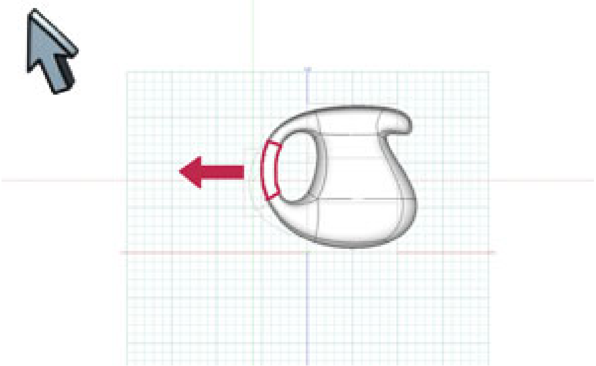
12. Use the **Bridge** tool again to click between faces near the top, as shown. The edges you click near while selecting faces determine the orientation of the bridge. Use the **Twist** parameter in the **Tool Options** to change the orientation if it is not correct.



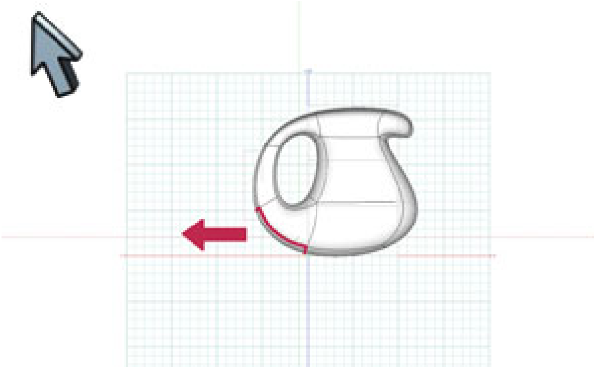
13. Return to a side view, and use the **Pick** tool set to **Segments** to move the segment at the top of the inside of the handle as shown.



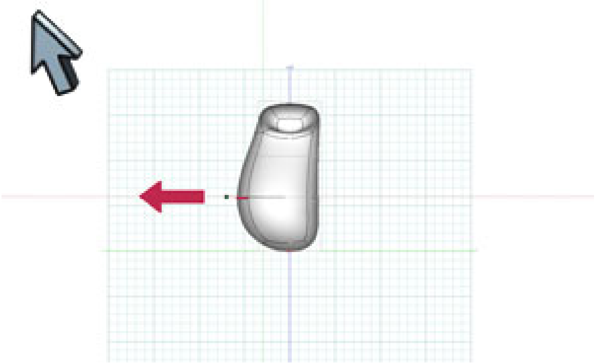
14. Use the **Pick** tool set to **Faces** to frame pick the faces associated with the back of the handle as shown, and drag them into position.



15. Use the **Pick** tool set to **Faces** to drag the bottom face of the handle backward.

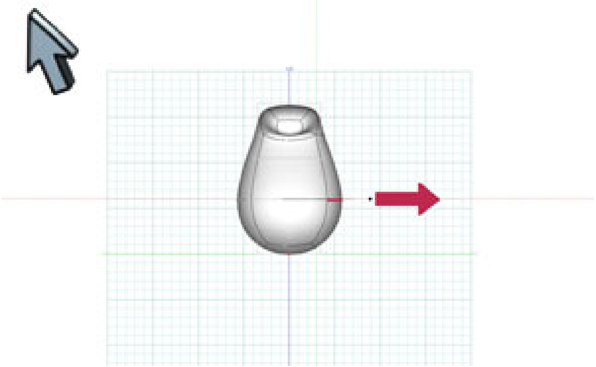


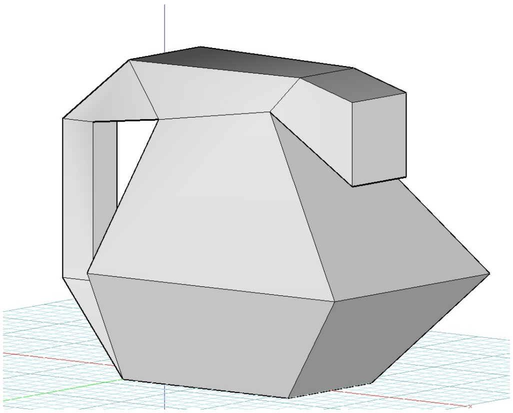
16. Switch to the front view and use the **Pick** tool set to **Segments** to drag the left side segment out as shown...



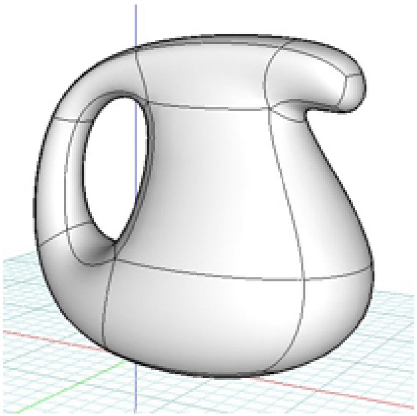
17. ...and then do the same with the other side.

The complete Water Pitcher is below.





The facetted version of the pitcher model, or “cage”.



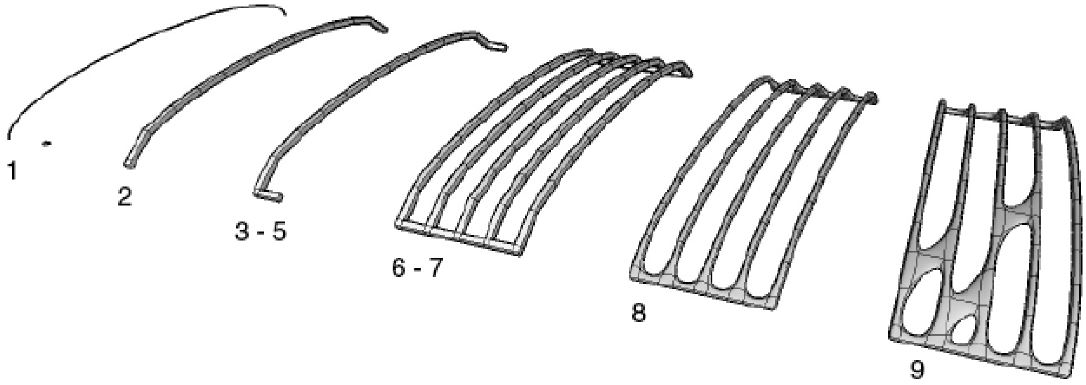
The Subdivision version of the model.

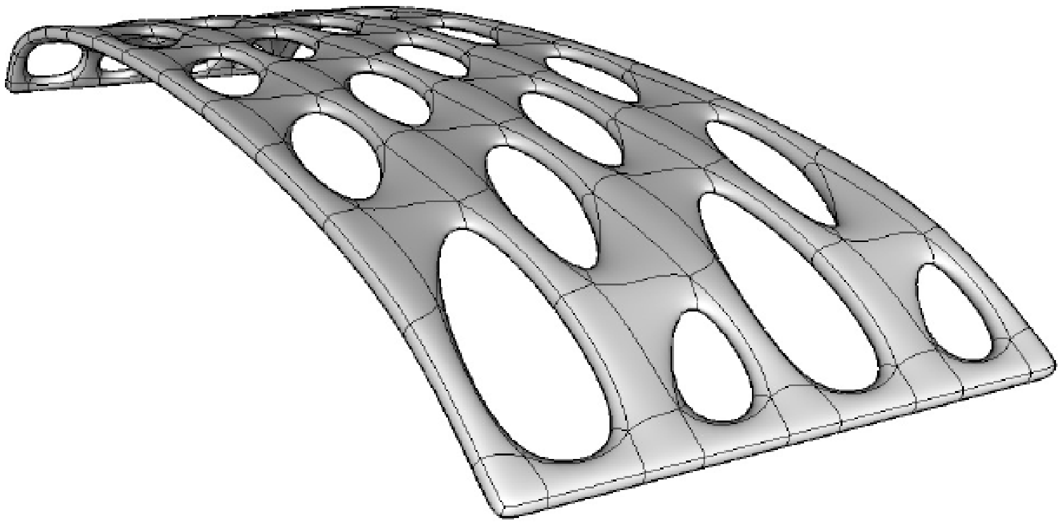
Subdivision Concept Stadium Roof Panel Example

After you have completed the previous tutorials, here is a prototype roof section, and general steps for it’s construction:

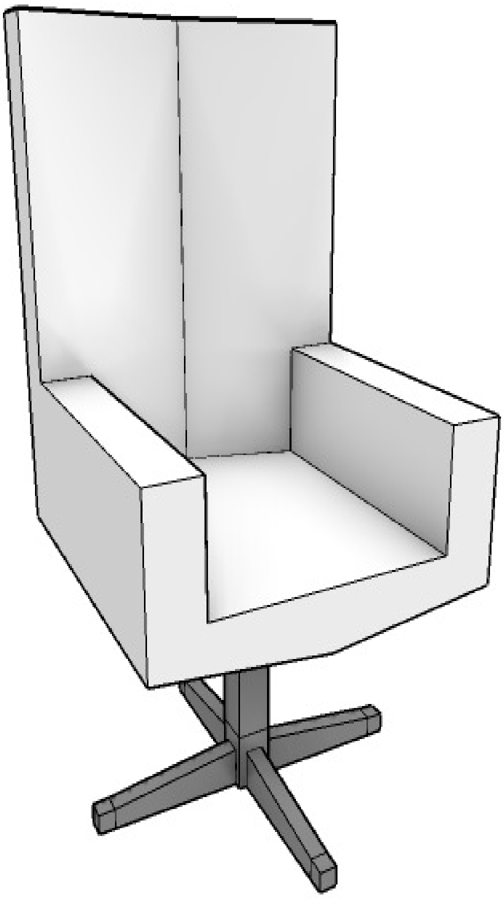
1. Begin with a single curved path and a sweep.
2. Use the **Axial Sweep** tool to create an arc.
3. Add the side segments to the side faces with the segment tool set to insert.
4. Use the **Reshape** tool set to **Keep Edges** to slightly extend each end.
5. Use the **Reshape** tool again to pull the ends out a bit as shown.
6. Use the **Move** tool with the **Multi-Copy** option, and use snaps to make a connected lattice.
7. Use the **Union** tool set to Keep Edges to union the objects into one.
8. Use the **Subdivision** tool to convert the facetted lattice into a subdivision surface.
9. Use the **Bridge** tool to click pairs of faces, and **form•Z** will create geometry to connect them.

Show Controls: Toggles the visibility of the controls, this is the same function as pressing F6.

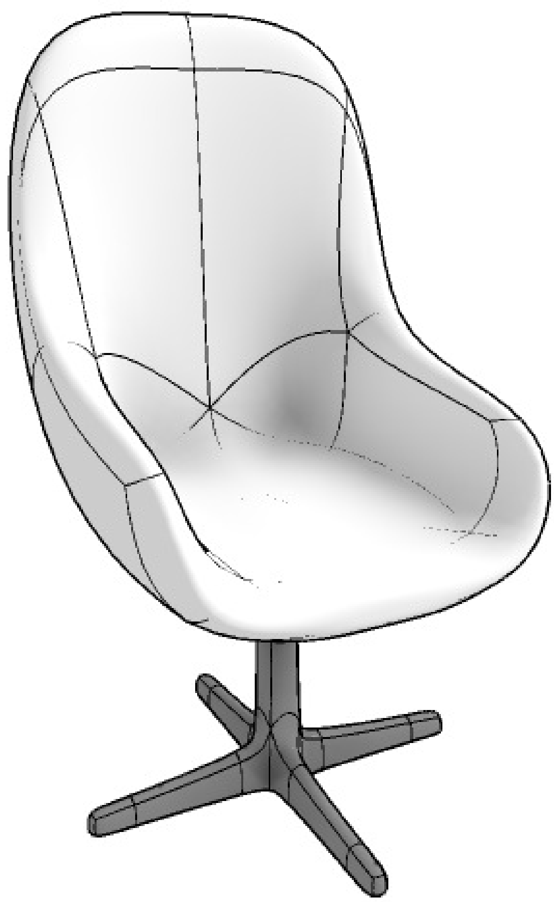




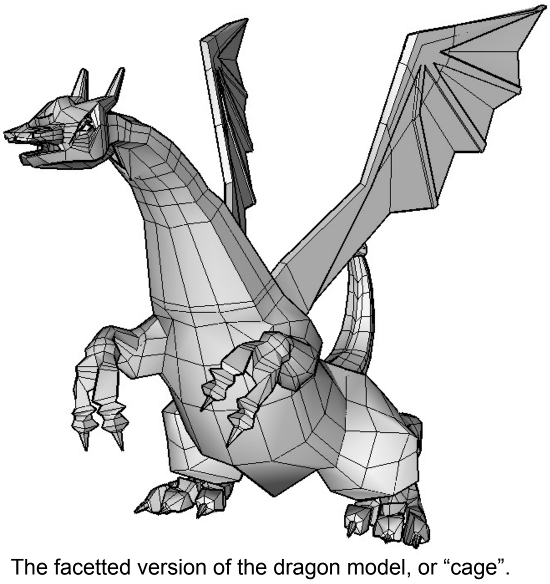
The final subdivision structure as completed with the **Bridge** tool.



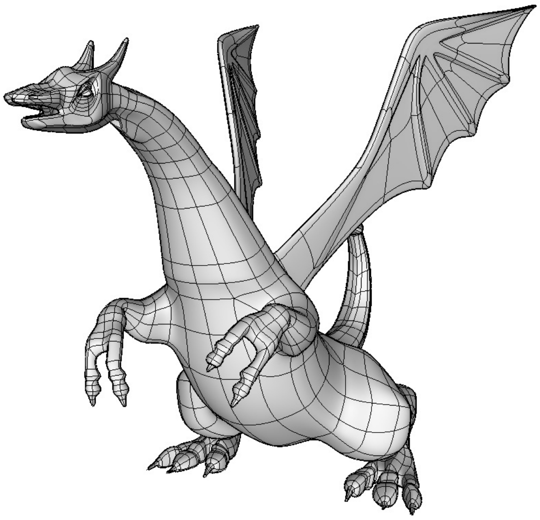
The facetted version of the chair model, or “cage”.



The Subdivision version of the model.



The facetted version of the dragon model, or “cage”.



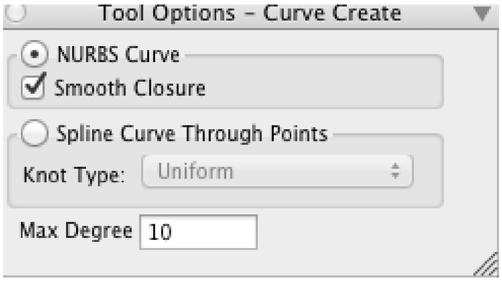
The Subdivision version of the model.

Curve Create

This tool creates a **NURBS Curve** or a **Spline Curve Through Points** from a vector line. The desired type is selected from the tool's options palette. To generate a curve, with the tool active, click on a vector line, which can be either open or closed. The spline curve is generated immediately and appears in edit mode, which means that its control points can still be manipulated. When the vector line is closed and a NURBS is generated the **Smooth Closure** option determines how its closing point will be treated.

The value in **Max Degree**, in combination with the number of points in the vector line, determine the degree of the curve. For NURBS, the degree is n-1, where n is the number of points in the vector line, if that number is less than the **Max Degree**. If it is greater, then n is equal to the **Max Degree**. For splines, the degree is n+1.

Knot Type is a popup menu containing three items: **Uniform, Chord Length**, and **Centripetal**. These produce different shapes when the lengths of the segments in a vector line differ significantly. See examples.



Tool Options - Curve Create

● NURBS Curve

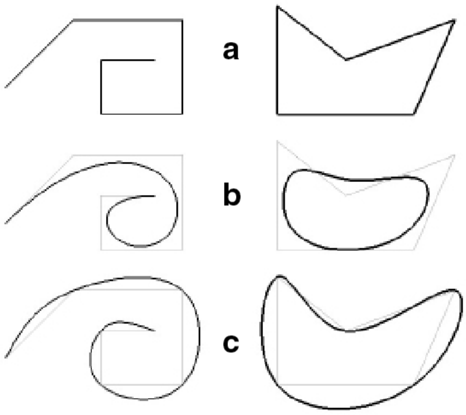
☑ Smooth Closure

○ Spline Curve Through Points

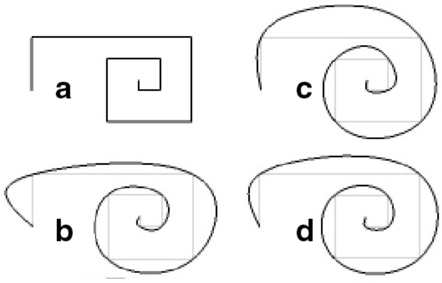
Knot Type: Uniform

Max Degree 10

Curve Create tool options palette.



Examples of curves: (a) original vector lines, (b) NURBS Curves, and (c) Spline Curves Through Points.

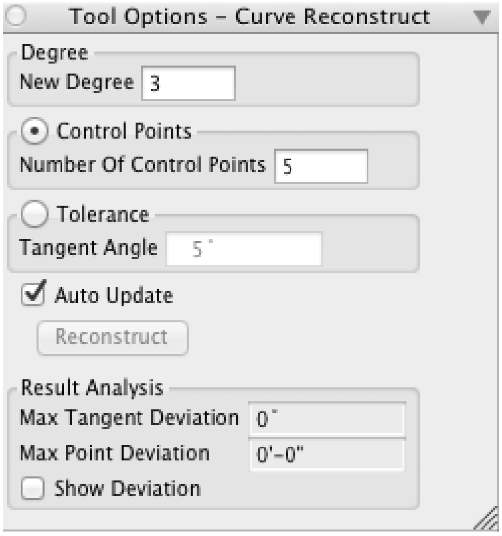


Types of splines: (a) original vector line, (b) Uniform, (c) Chord Length, and (c) Centripetal.

Curve Reconstruct

This tool replaces a curve with a new NURBS curve of different specifications, set in the tool options palette. The new curve is a best approximation of the previous one. To reconstruct a curve, with the **Curve Reconstruct** tool active, click on the curve. The degree and number of control points of the curve are displayed in the tool options palette, which appears as soon as you click on a curve (and not when you activate the tool).

When a new value is entered into the **New Degree** or **Number Of Control Points** or **Tangent Deviation** fields, the curve is reconstructed according to those new parameters. The deviations from the previous curve are displayed in the **Results Analysis** section and if **Show Deviation** is on the differences between the two curves are shown graphically.


Tool Options – Curve Reconstruct

Degree
New Degree 3

● Control Points
Number Of Control Points 5

○ Tolerance
Tangent Angle 5°

☑ Auto Update

Result Analysis
Max Tangent Deviation 0°
Max Point Deviation 0'-0"
☐ Show Deviation

The Curve Reconstruct tool options palette.

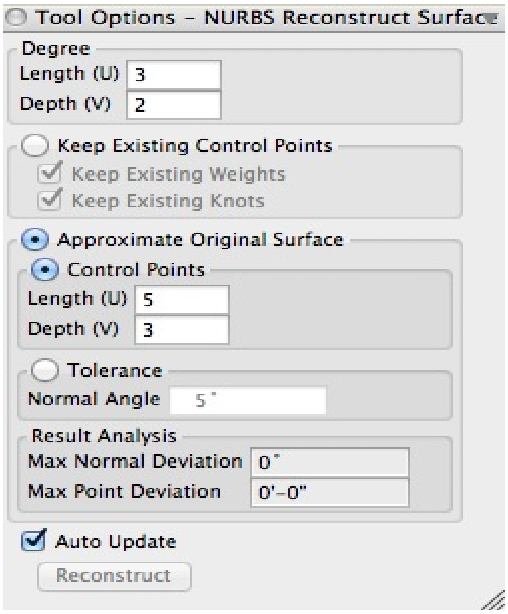
NURBS Reconstruct

Similar to the **Curve Reconstruct** tool, the **NURBS Reconstruct** tool will replace a NURBS surface with a new NURBS surface based on source shape or parameters.

To reconstruct a surface, with the **NURBS Reconstruct** tool active, click on the surface. As soon as this is done the **NURBS Reconstruct** tool options palette is invoked and displays the current values of the parameters of the selected surface. That is, the **Degree** and number of **Control Points** of the surface, in both the **U (Length)** and **V (Depth)** directions are shown.

The **Reconstruct** tool functions in two distinctly different methods. When **Keep Existing Control Points** is selected, the control points are maintained and the shape of the surface is changed to match the desired degree (optionally keeping exisitng weights and knots as well).

When **Approximate Original Surface** is selected, the reconstructed surface matches the original surface as closely as possible using the specified parameters.


Tool Options – NURBS Reconstruct Surface

Degree

Length (U) 3

Depth (V) 2

○ Keep Existing Control Points

☑ Keep Existing Weights

☑ Keep Existing Knots

● Approximate Original Surface

● Control Points

Length (U) 5

Depth (V) 3

○ Tolerance

Normal Angle 5°

Result Analysis

Max Normal Deviation 0°

Max Point Deviation 0'-0"

☑ Auto Update

The NURBS Reconstruct tool options palette.

If **Auto Update** is checked, the surface is reconstructed whenever a new value is entered into one of the fields. If **Auto Update** is unchecked, changes are applied when the **Reconstruct** button is clicked.

Place Text

This tool is used to place text. When you activate the tool, its options palette appears, as usually. With the tool active, you click on the reference plane or the face of an object, where you want the text to be generated. The **Text Editor** dialog is invoked, where you type the text you wish to generate and you select a font and other text parameters. You press OK to close the dialog and the text is generated in edit mode, which allows you to further manipulate its parameters, either graphically, using the controls displayed, or by changing the settings in the tool options palette.

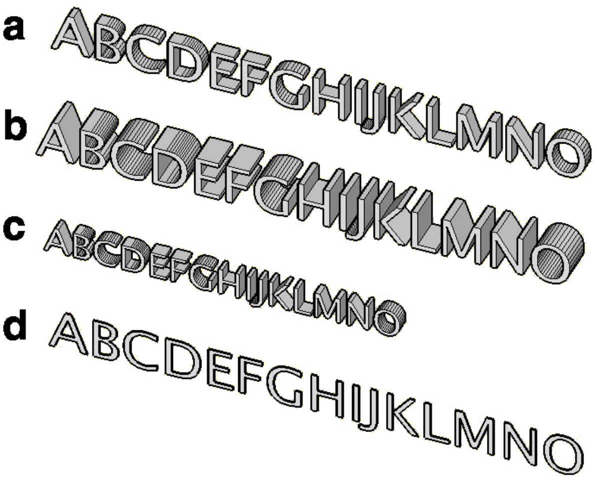
The text can be **Facetted** or **Smooth** and it can be solid or surface object.

Different options can be selected from the **Height Base** pop-up menu for the calculation of the height, which is typed in the **Height** field. **Top**, **Center**, or **Bottom**, which are selected from the pop-up menu, control the justification of the text along its height.

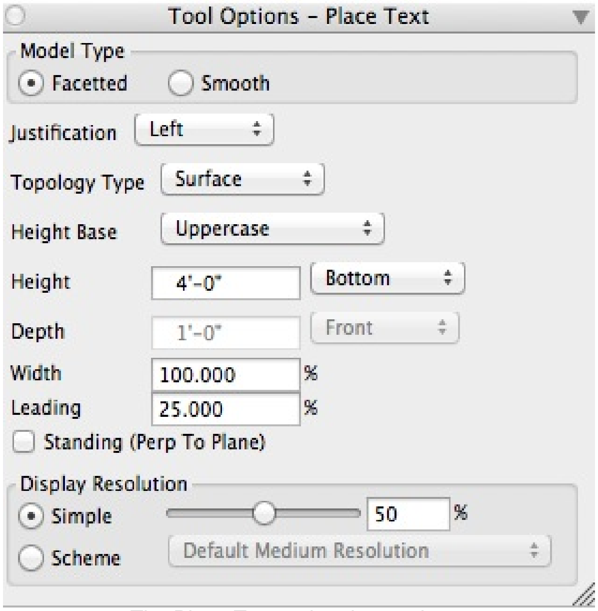
The **Depth** value may be relative to **Front**, **Middle**, or **Back**, which is selected from the pop-up menu.

The **Width** of text is relative to its height and varies by character. It is expressed as a percentage, which preserves the width variations. Likewise, the **Leading** space is expressed as a percentage.

When **Standing (Perpendicular To Plane)** is off, the text lies flat on the plane. When on, it is standing on the plane. See example.



(a) Solid Standing text,
(b) after increasing its width,
(c) after reducing its size, and
(d) after changing it to surface text.


Tool Options – Place Text

Model Type

● Facetted ○ Smooth

Justification Left

Topology Type Surface

Height Base Uppercase

Height 4'-0" Bottom

Depth 1'-0" Front

Width 100.000 %

Leading 25.000 %

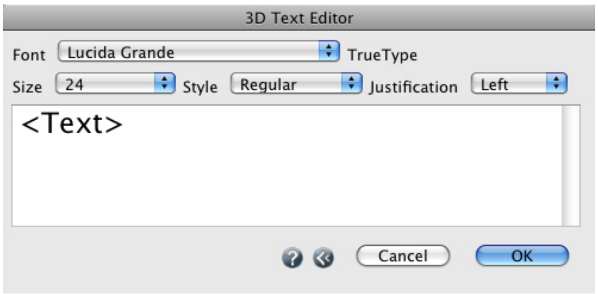
☐ Standing (Perp To Plane)

Display Resolution

● Simple 50 %

○ Scheme Default Medium Resolution

The Place Text tool options palette.

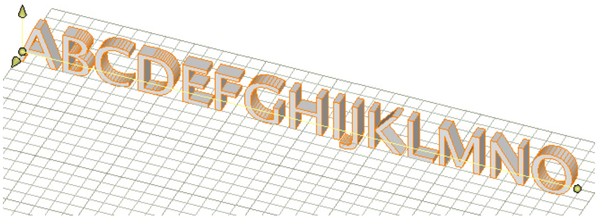

3D Text Editor

Font Lucida Grande TrueType

Size 24 Style Regular Justification Left

<Text>

The 3D Text Editor dialog.



Solid text, Standing, as initially generated in edit mode.

Creating and Placing Components

Components are predefined models that are provided in libraries and can be placed as instances in projects. **Components** can also be an object or group of objects that are created in the project for repetitive use (instances). They are similar in nature to what other applications call symbols, parts, or blocks. **Windows** and **Doors** are a special type of component that includes some additional information needed to place them meaningfully into a model. The available components are displayed in the **Component Manager** palette (accessed from the **Palettes** menu).

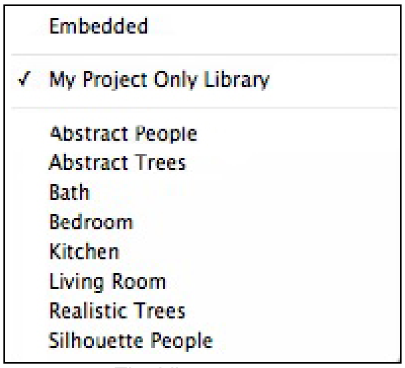
A library is simply a folder or directory containing **bonzai3d** (.b3d) or **form•Z** (.fmz) files. Each file/directory defines a single component. When a component is placed in the project, it is embedded into the project making it unnecessary to transfer the original external files with the project. The links to the original component are maintained so that, if the original (the definition) is changed, the changes can be optionally propagated in the project file and vice versa..

In addition to the component related tools described in this section, components can be edited in the project using the **Edit Group/Component** and **Edit Group/Component Complete** items found in the **Edit** menu. **Make Individual Component (Edit Menu)** makes new definitions in the project from a selected instance.

Component Manager palette

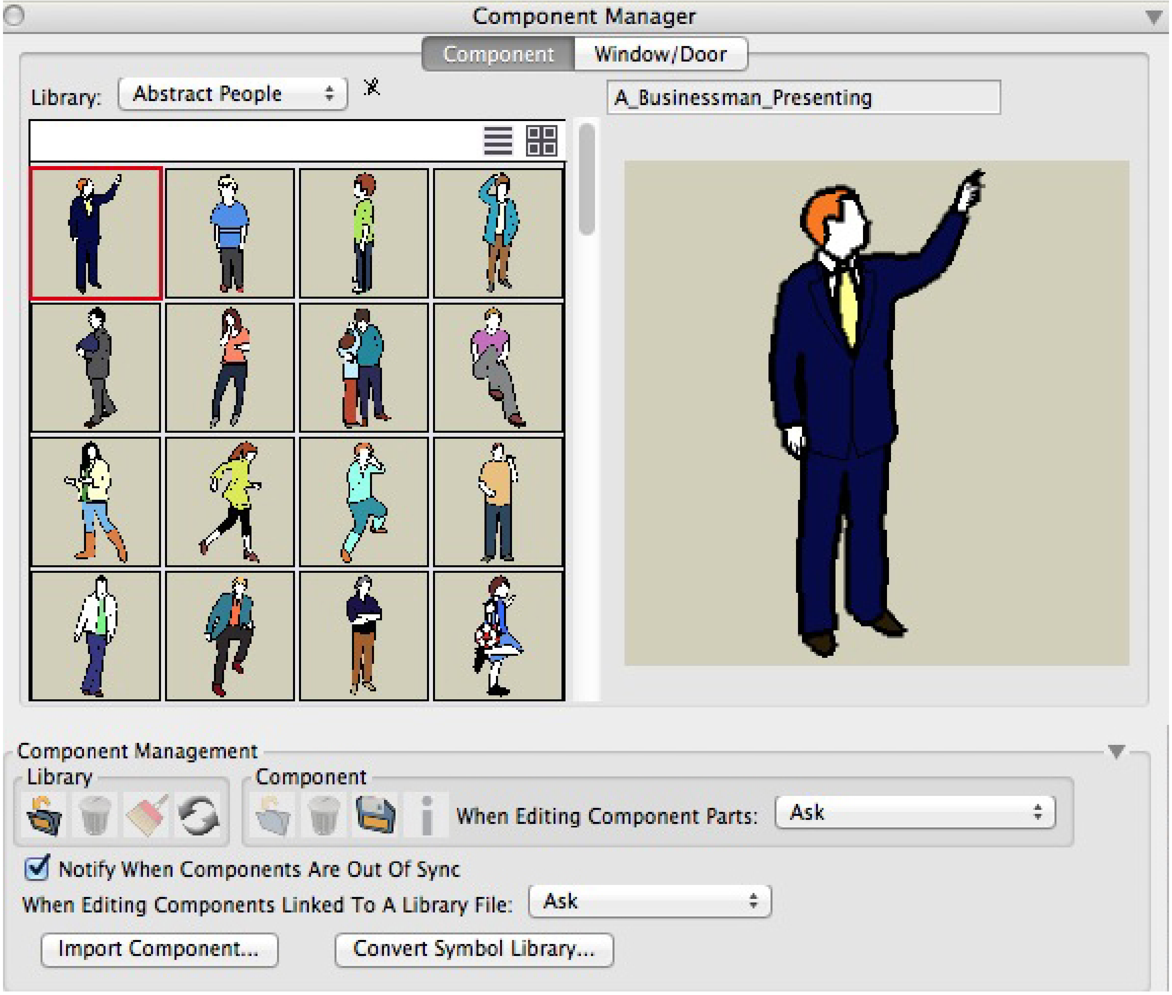
This palette displays the components that are currently available to be used. The **Component** and **Window/Door** tabs at the top are used to select between regular components and the specialized window/door components.

The **Library** menu lists libraries (categories) of components. The area below the menu displays thumbnails depicting the components contained in the currently selected library. One of these items is the active component as indicated by a border around the image. A larger preview of the active component is displayed to the right of the thumbnails with its name above it. **Components** can also be displayed in a **List** mode, in which the components are shown by their names. This can be quite useful when you have very similar components that are hard to tell apart in **Icon** mode.



The Library menu.

The first item in the menu is **Project**. This represents components that have been placed in the project or created in the project. This will be empty for a new project. The second group of items are categories of predefined components that are provided with the software (located in the **Component Library** folder). The third library is titled **Downloads** and contains components that have been downloaded from the Internet. The last group contains component libraries that have been created locally on your machine (in the **Documents** folder). The **Add Library** item at the bottom of the menu is used to create a new library on your machine. New libraries are added to the **Documents** folder.



Library: Abstract People

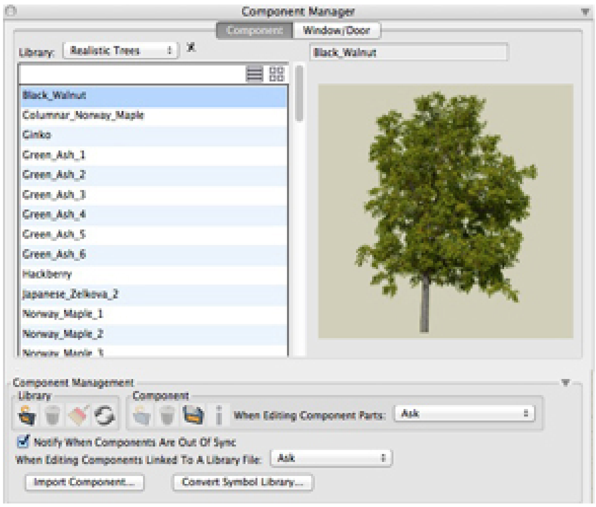
A_Businessman_Presenting

When Editing Component Parts: Ask

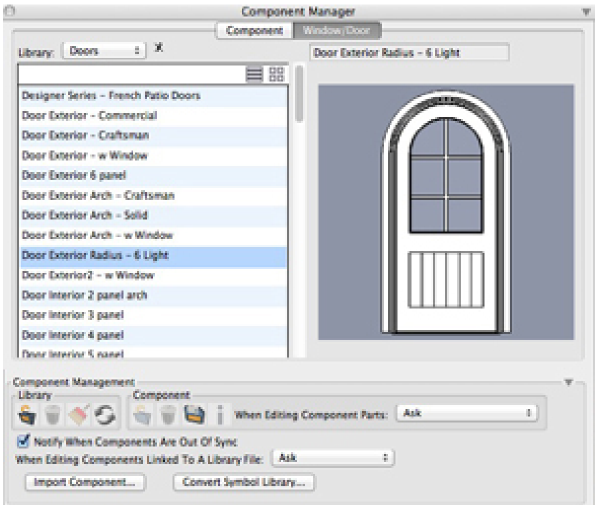
☑ Notify When Components Are Out Of Sync

When Editing Components Linked To A Library File: Ask

The Component Manager palette.



The Components Manager in view by List mode.


Component Manager
Component
Window/Door
Library: Doors
Door Exterior Radius - 6 Light
Designer Series - French Patio Doors
Door Exterior - Commercial
Door Exterior - Craftsman
Door Exterior - w Window
Door Exterior 6 panel
Door Exterior Arch - Craftsman
Door Exterior Arch - Solid
Door Exterior Arch - w Window
Door Exterior Radius - 6 Light
Door Exterior2 - w Window
Door Interior 2 panel arch
Door Interior 3 panel
Door Interior 4 panel
Component Management
Library
Component
When Editing Component Parts: Ask
Notify When Components Are Out Of Sync
When Editing Components Linked To A Library File: Ask
Import Component...
Convert Symbol Library...

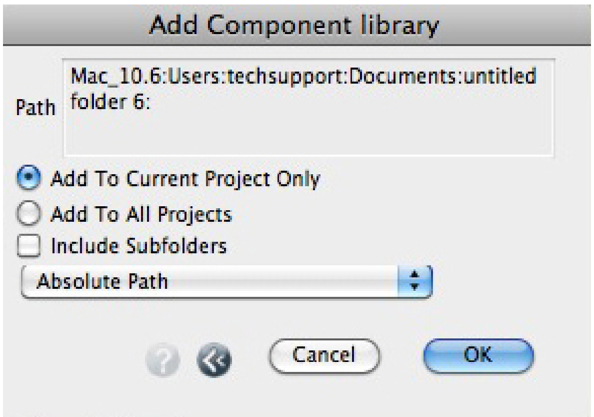
The Window and Door Component Manager, in List mode.

The **Component Management** section at the bottom of the palette contains tools for managing the components.

The **Library** section affects **libraries**:

Add Component Library...: It first invokes the standard **Open File** dialog, where you select the library folder you wish to add. A new empty library can be created by selecting **New Folder** at the bottom of the dialog. It then invokes the **Add Component Library** dialog, where a few characteristics of the new library are set.

You may **Add To Current Project Only** or **Add To All Projects**, which is, you add it as a **Project** or **System** level library. You may want to **Include Subfolders**, which are the contents of any folders inside of the selected library folder. Only subfolders that contain **form•Z** files are added. Finally you select a file search path from the popup menu at the bottom of the dialog. The options are: **Absolute Path** (default), **Relative To Application**, **Relative To Project File**, and **Relative To User Document Folder**. These are discussed in the **Preferences: Project: File Search Paths** section of this manual.


Add Component library

Path: Mac_10.6:Users:techsupport:Documents:untitled folder 6:

● Add To Current Project Only
○ Add To All Projects
☐ Include Subfolders

Absolute Path

The Add Component Library.

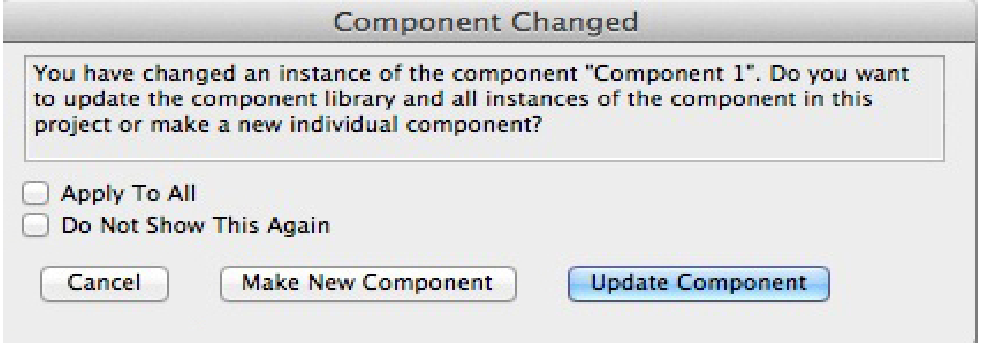
Delete Component Library...: Pressing this button deletes the highlighted library. There are two levels of deletions: **Delete Library And All Files** deletes the library folder/directory completely. **Remove Reference To Library** preserves the folder on your computer disc but deletes it from your component libraries list.

Purge Unused Components From Library...: Pressing this button deletes unused components from the **Embedded** library. This button is only available when the **Embedded** library is active.

Refresh Libraries...: After placed components have been edited, they may differ from the definitions in the original files. Pressing this button brings fresh definitions into a project.

The **Component** section affects the active component:

Edit Component...: Opens the component for editing. When this is selected the component file is opened as a separate project. This project becomes the active project where the component definition can be edited. When the file is saved, the component library is updated with the new version.



Component Changed

You have changed an instance of the component "Component 1". Do you want to update the component library and all instances of the component in this project or make a new individual component?

☐ Apply To All
☐ Do Not Show This Again

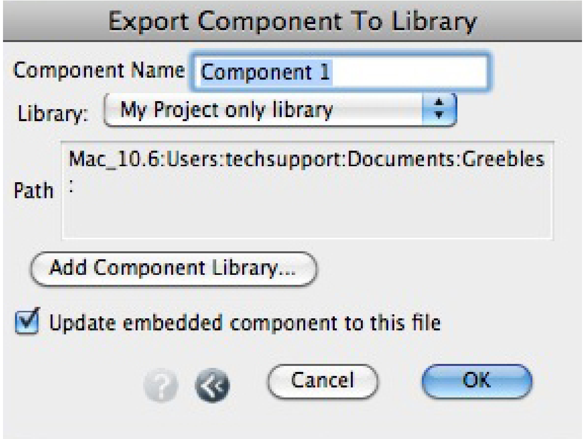
The Component Changed dialog.

The **Component Changed** dialog appears whenever a change is made to a component definition. There are options for Updating the original component definition, and also creating an entirely new component.

Cancel: Whenever a change is made to a component definition, the dialog now has an option to cancel the change and restore the component back to its original definition.

Delete Component...: This button deletes the active component. If there are instances of the component in the file, they are automatically exploded (i.e. the objects remain, but they are no longer part of a component).

Export Component To Library...: Exports the active component to an external file. This can be used to export an embedded component from the project to an external component file. Pressing this button invokes the **Export Component To Library** dialog, where you set the **Component Name** and the **Library** it is going into. This may be a library already existing at the project or system level, or you can click on the **Add Component Library...** button to add a library, as with the similar command in the **Components Manager** palette.



Export Component To Library

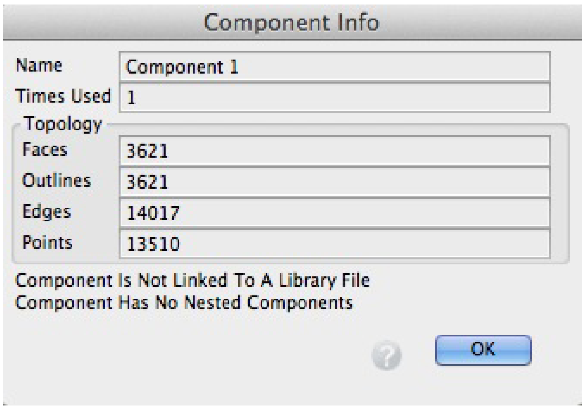
Component Name: Component 1
Library: My Project only library
Path: Mac_10.6:Users:techsupport:Documents:Greebles:

☑ Update embedded component to this file

The Export Component to Library dialog.

Info About Component: This option invokes a dialog that lists information pertinent to the component that is highlighted in the library. The information displayed in the dialog is shown below and shows the component's name, the number of times the component is used in the project, the number of each sub-topology element, if it is linked to a library file, and if it contains nested components. An example of the **Component Info** dialog is shown at right.

When **Editing Component Parts** there are three options: **Update Component**, which updates the current definition of the component; **Make New Component**, which leaves the original definition as is and creates a new definition of a component; and **Ask**, which asks the user at the time the component is being edited.



Component Info

Name: Component 1
Times Used: 1
Topology
Faces: 3621
Outlines: 3621
Edges: 14017
Points: 13510

Component Is Not Linked To A Library File
Component Has No Nested Components

The Component Info dialog.

Notify When Components Are Out Of Sync: Components linked to external files are automatically updated in the project when the component file is updated. That is, the component will be reloaded, when it is found to have changed. When this option is checked, a warning is issued to notify you that a component has changed. **Components** are reloaded when the project is opened and when the application is activated, after having first been de-activated. Note that components can also be manually updated using the **Linked Files** tab of the **Project** Info dialog.

When Editing Components Linked To A Library File: When embedded components are edited and get out of sync with the libraries they originally came from, there are three options: **Update Library**

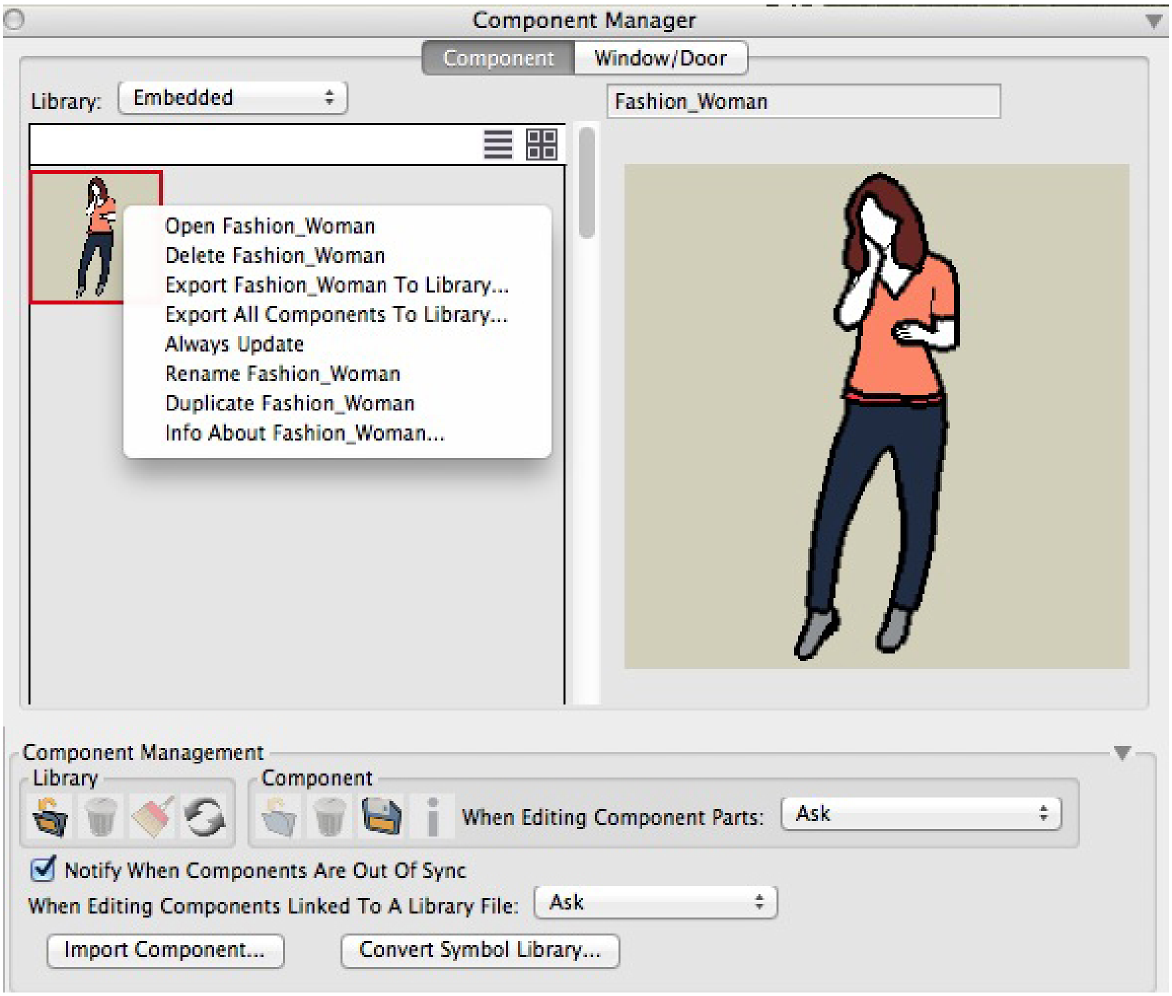
File, which revises the definition in the file; **Break Link**, which makes the embedded component independent of the original definition; and **Ask**, which asks the user at the time the editing occurs.

Import Component...: This button is used to convert a file into a component. The standard open file dialog is presented for the selection of the desired file. Any supported file type may be selected (bnz, skp, obj, kmz, etc). The contents of the file becomes an embedded component and is ready to be placed in the project.

Convert Symbols Library...: This button is to be used for converting any "symbol" libraries defined in **form•Z** versions earlier than 7 to component libraries. Clicking on it invokes the standard **Open File** dialog, where you choose the symbol library folder/directory you wish to convert. As soon as you click on the **Choose** button, the conversion occurs, but may require a little time for large libraries. Once the conversion has been completed you save the new version as a **Components Library** and the process is completed.

Component Library Context Menu

Right-clicking on an embedded component preview icon in the **Component Manager** invokes a context menu that also has options for managing individual components. Some are the same as the options described above.



Library: Embedded

Fashion_Woman

When Editing Component Parts: Ask

☑ Notify When Components Are Out Of Sync

When Editing Components Linked To A Library File: Ask

The Component Manager palette with right click context menu.

Open: open an embedded component for editing.

Delete: delete an embedded component from the Library.

Export to Library: export an embedded component from the embedded Library to an external component library.

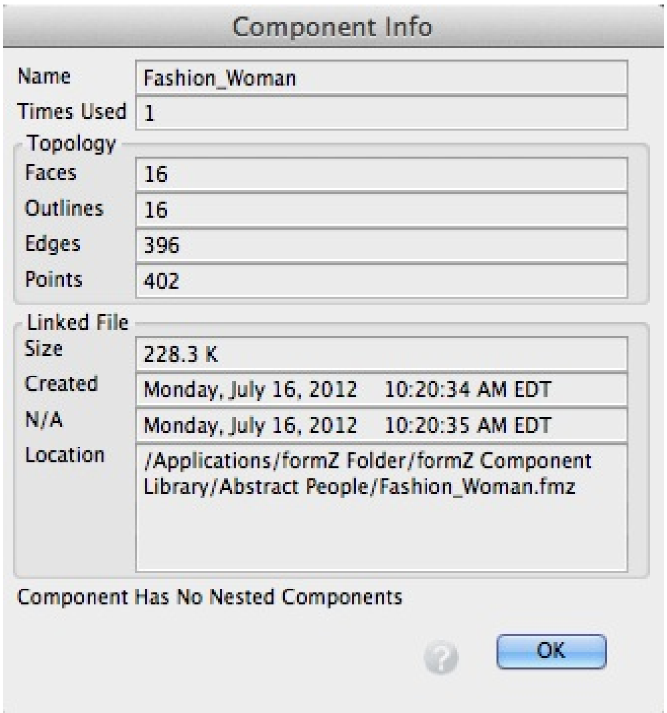
Export All Components to Library: export all embedded components from the embedded Library to an external component library.

Always Update: when this is checked, changes made to the embedded component will always propogate to the component's external library.

Rename: you can change the name of a component from within the **Component Manager**.

Duplicate: you can duplicate a Component from within the **Component Manager**.

Info About: This brings up the **Component Info** dialog as discussed previously. An example of choosing this option with the Fashion Woman component selected. Note that it shows the path to the linked file and it's file information.



Component Info

Name: Fashion_Woman
Times Used: 1

Topology
Faces: 16
Outlines: 16
Edges: 396
Points: 402

Linked File
Size: 228.3 K
Created: Monday, July 16, 2012 10:20:34 AM EDT
N/A: Monday, July 16, 2012 10:20:35 AM EDT
Location: /Applications/formZ Folder/formZ Component Library/Abstract People/Fashion_Woman.fmz

Component Has No Nested Components

The Component Info dialog.

Place Component

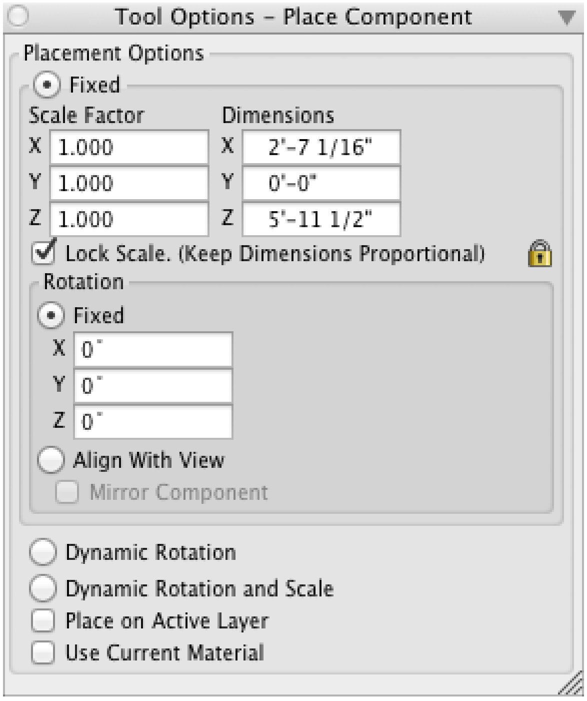
The **Place Component** tool is used to place an instance of a component into a modeling project. When the tool is selected, the component manager palette appears (if it is not already visible). Select the desired component item to place or press the space bar to use the currently active component. The component appears with its origin aligned at the mouse cursor and moves with it. Click on the desired location in the modeling window to fix the location. The component is placed perpendicular to the active reference plane or perpendicular to the face of an existing object. The dimensions and orientation of the component can be fixed or set dynamically. The placement method is controlled by options in the **Tool Options** palette.

Placement Options: The options in this group specify how the component is sized and oriented.

Fixed: When this method is on, a single click determines the location. The **Size** of the component is determined by the **Scale** and **Dimension** fields in the tool options. These are linked fields that determine the size in the X, Y and Z directions and allow for specification by a scale factor (multiplier) or actual desired dimension. The **Keep Proportional** option synchronizes the dimensions so that when one dimension is changed, the other dimensions are changed based on the proportions of the component.

Dynamic Rotation: When this method is on, the first click determines the location of the component. The second click determines the orientation. The scale matches the original component file.

Dynamic Rotation And Scale: With this option on, the first click determines the location of the component. The second click determines the orientation and size.



Tool Options - Place Component

Placement Options

● Fixed

	Scale Factor		Dimensions
X	1.000	X	2'-7 1/16"
Y	1.000	Y	0'-0"
Z	1.000	Z	5'-11 1/2"

☑ Lock Scale. (Keep Dimensions Proportional)

Rotation

● Fixed

X 0°

Y 0°

Z 0°

○ Align With View

☐ Mirror Component

○ Dynamic Rotation

○ Dynamic Rotation and Scale

☐ Place on Active Layer

☐ Use Current Material

The Place Component Tool Options palette.

Place On Active Layer: If this option is off, new layers will be added to the project (if necessary) to match the layers of the original component file. If this option is on, all new component will be placed on the active layer.

Use Current Material: If this option is off, the materials from the original component file will be transferred and will be added to the project. If the option is on, all component objects will be assigned the active material.

Align To View: When this option is on, a component placed in a project will rotate to face the current view. In cases where the component is a single face, the face normal is aligned with the current view. In cases where a component is made up of multiple faces, the X axis of the component file is aligned with the current view.

Mirror: When on, the component is placed as a mirror image of the original.

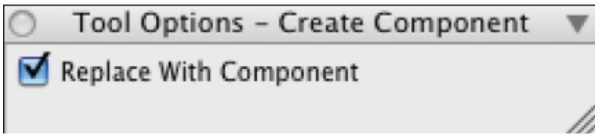
Create Component

This tool allows you to convert selected objects to a component. You can preselect the objects and then, with the tool active, click to define the origin and complete the operation. Or you can postpick the objects as a set. The new component can be added to a library you designate by selecting its name and also to the **Embedded** library, which becomes the active library.

The **Tool Options** palette has one option: **Replace With Component**. When selected, the original objects are replaced with the newly created component. More options are set in the **Create Component** dialog, which is invoked as soon as the final selection click is entered.

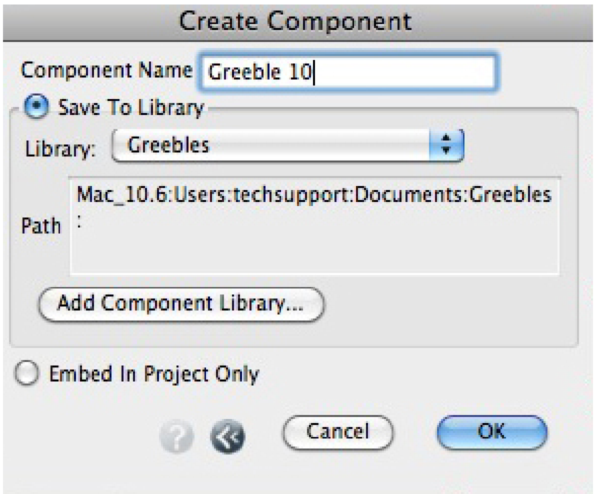
Component Name: In this field you enter the name of the component.

Save To Library will place the component in the **Library** whose name is selected or you may click on **Add Component Library...** to add a new library at the project or system level. Alternatively, you can click on **Embed In Project Only**, which will only place the new component in the **Embedded** library and no other library.



☑ Replace With Component

The Create Component Tool Options palette.



Component Name: Greeble 10

● Save To Library

Library: Greebles

Path: Mac_10.6:Users:techsupport:Documents:Greebles:

○ Embed In Project Only

The Create Component dialog.

Explode, Replace, and Make Individual Component

Explode Component

This tool decomposes the component you click on to its parts, which become common objects.

Replace Component

This tool replaces the component you click on with the active component. You can replace more than one components by prepicking them. You can use this tool to also replace common objects with components.

Make Individual Component

This tool makes a new separate component definition for the component you click on.

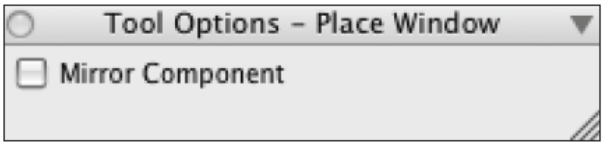
Place Window/Door

The **Place Window/Door** tool is similar to the **Place Component** tool. The main difference is that the **Place Window/Door** tool has the ability to cut an opening into an object at the time the component is placed. In addition, the Place Window/Door tool does not allow the component to be rotated or scaled at the time it is placed.

Windows and doors become associated with the object that they are inserted into. This allows the windows and doors to behave as follows:

- When an object is deleted, all associated windows and doors are deleted as well.
- When an object is transformed, all associated windows and doors are transformed as well.
- When a window or door is deleted, the hole (opening) created by the window or door is filled.

The **Place Window/Door Tool Options** palette only has a single option. **Mirror Component** is similar to the analogous option for **Place Component**.



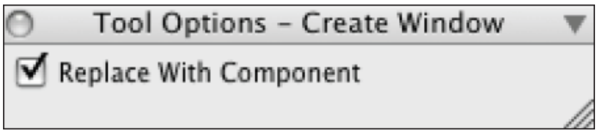
The Place Window/Door Tool Options palette.

Components intended to be used as windows/doors must have at least two required layers labeled **Component Frame** and **Component Interior Trim**. See the **Create Window/Door** section for more details on the specifications of the two required layers.

Create Window/Door

The **Create Window/Door** tool allows you to save selected objects as specialized **Window/Door** component. The newly created component is added to the **Project** library. The click point defines the origin of the new component group. When **Replace With Component** is selected, the original objects are replaced with a component group (instance) and the original objects are deleted. More options are set in the **Create Component** dialog as discussed in the respective section.

Windows and doors must be created in a certain manner in order for the **Place Window/Door** tool to be able to place them properly:



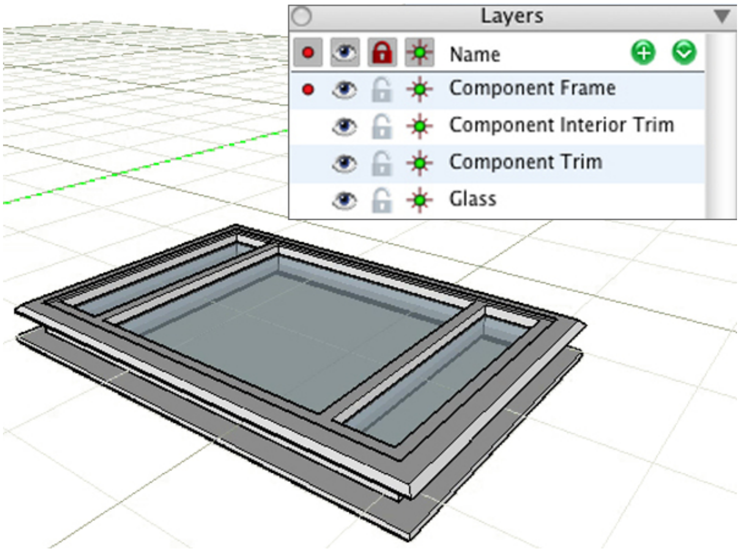
Tool Options – Create Window

☑ Replace With Component

The Place Window/Door Tool Options palette.

- The window or door component must be created flat on the **XY** plane, so that it may be properly rotated when placed on a vertical surface.

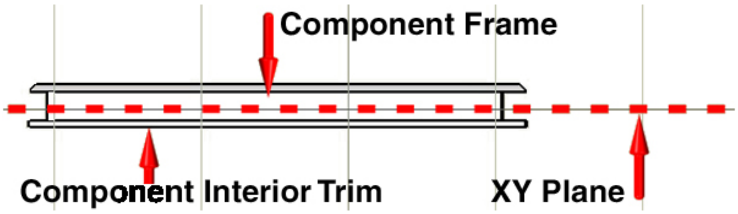
- The ***world origin*** of a component file is used when placing a window or door. The components provided with **form•Z** always have their origins at their lower left corners.



A 3D view of a window.

- The objects on layer named **Component Frame** determine the shape of the opening to be cut into the wall, into which the component will be placed. The shape is determined by the intersection of the frame and the **XY** plane. Therefore, the window or door frame object must extend above and under the **XY** plane. See illustration.

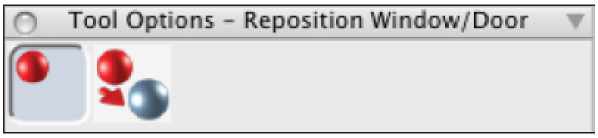
- The objects on layer named **Component Interior Trim** determine how the component frame is stretched to match the depth of the wall. To work properly, the objects on this layer need to be below the XY plane, as shown.



Front view of a window.

The example above is of a window component with the **Layers** palette shown. The two images illustrate the requirements of a window/door component.

Reposition Window/Door



The Reposition Window/Door Tool Options palette.

The **Reposition Window/Door** tool allows you to move or copy window/door components. This is different from the **Move** tool, which will move a window/door but leave the hole on the wall behind. To reposition, click on an existing window/door. The plane of the face where the window/door is becomes the active reference plane. Move the window/door to the new location and then click again to complete the operation. This tool can also be used with the prepick method to reposition many windows/doors.

The icons in the **Tool Options** palette stand for **Self** and **Copy** and determine if the original door/window or a copy is repositioned.

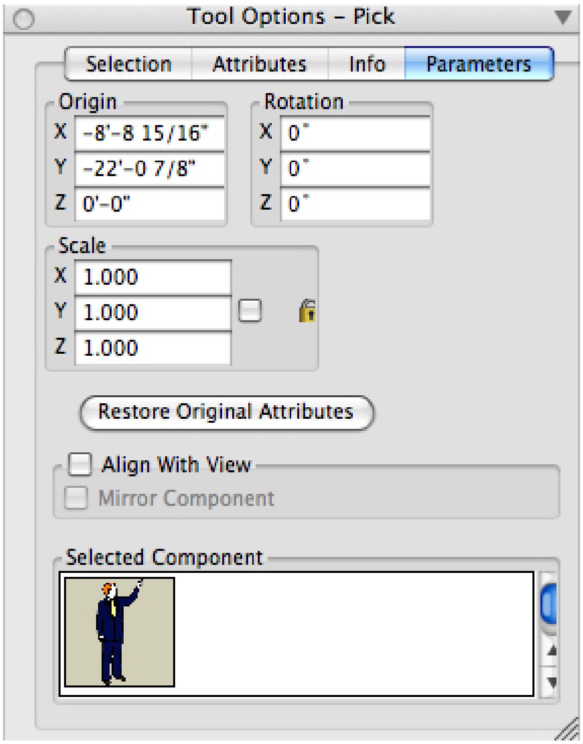
Editing components through the Pick palette

Selecting component instances only (and no other type of entity) causes their parameters to appear in the **Tool Options** palette. If only one component is selected, its parameters appear. If many components are picked, any parameters that are common to all selected components will appear, otherwise "[multiple]" is displayed.

The selected components can be edited by changing information in the **Tool Options** palette. For example, the position can be altered by changing the coordinates under **Origin**. Similarly, rotation and scale can also be changed by changing the values in the respective fields.

Altering the option selections for **Place On Active Layer**, **Use Current Material**, or **Align With View** causes the selected component to be updated as though placed using these settings.

Selected Component: This window displays the thumbnails of selected components. A component can be replaced by dragging a thumbnail from the **Component Manager** palette or by double clicking on the component and selecting a different component from the component picker.



Origin
X -8'-8 15/16"
Y -22'-0 7/8"
Z 0'-0"

Rotation
X 0°
Y 0°
Z 0°

Scale
X 1.000
Y 1.000
Z 1.000

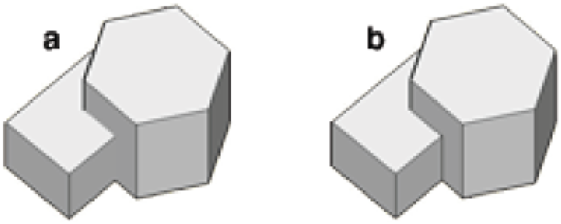
☐ Align With View
☐ Mirror Component

Selected Component

The Pick Tool Options palette when selecting a component.

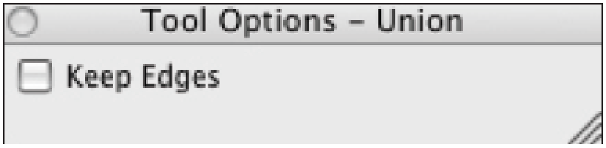
Union

This tool merges two intersecting objects together. If the objects do not overlap, the result is the objects themselves. In its simplest manifestation it involves two objects. To apply it, with the tool active, click on the two objects. The result appears immediately and the original objects are ghosted.



(a) Original objects
and (b) the objects unioned.
They look the same but the latter
is all a single volume.

When the objects that are unioned contain coplanar faces, the resulting object also contains coplanar faces the edges between which may be kept or filtered out. This depends on whether the **Keep Edges** in the **Union** tool options palette is on or off.

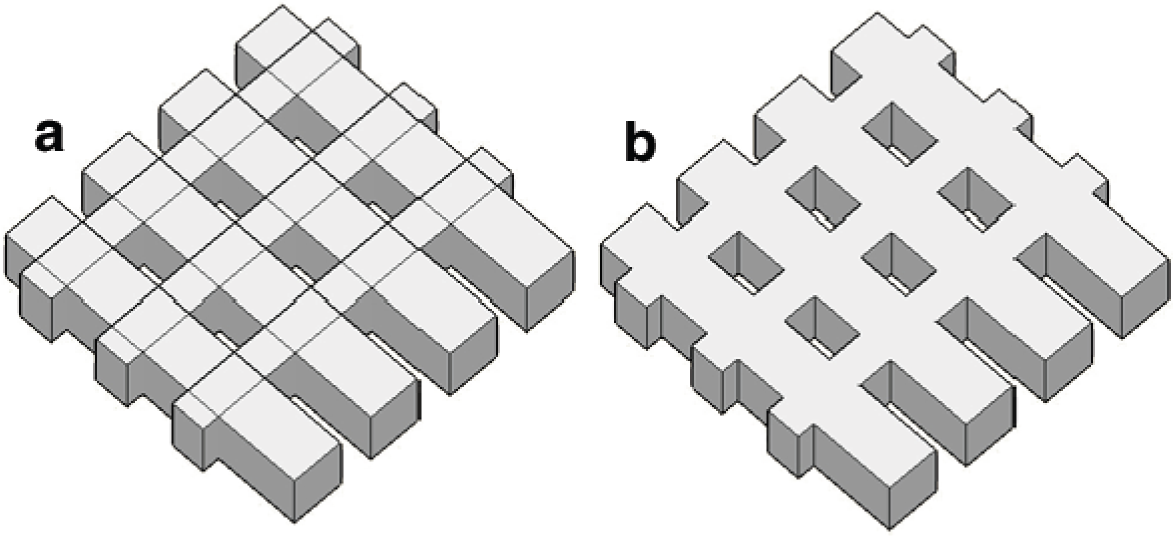


Tool Options – Union

☐ Keep Edges

The Union tool options palette.

It is sometimes required to union many objects. While such unions can be executed one at a time, by sequentially picking pairs of objects, they can also be executed all in one step. The objects can be prepicked using either an area pick method, or by picking them individually with the **Pick** tool while pressing ***shift*** and then, with the **Union** tool clicking anywhere in the project window. Or the postpick method can be used by multi-picking the objects sequentially with the **Union** tool, while pressing shift, then releasing shift and clicking anywhere in the project window. See example.



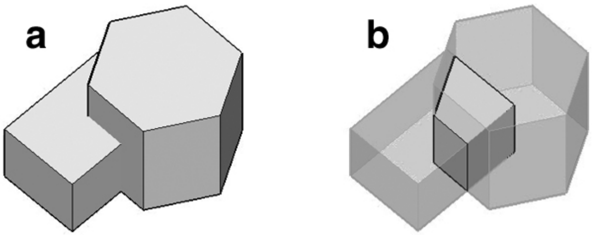
(a) Original objects and (b) the unioned object.

Intersection

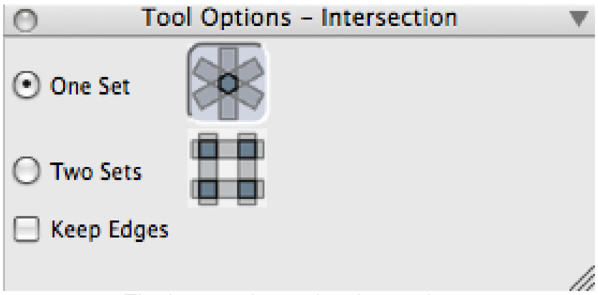
In its simplest manifestation, this tool returns the common volume of two objects, as shown in the example. To apply the operation, with the tool active, click on the two objects. The result is produced immediately and the original objects are ghosted.

When the tool is applied to multiple objects, two options are available and selectable from its tool options palette. When **One Set** (the default) is on, the operation requires picking one set of objects and returns the common volume of all of them. When the picked objects have no common volume, the result is an empty object (no result appears). When **Two Sets** is on, the operation requires picking two sets of objects and returns the common volume of any pair of objects, where one object is from the first and the other from the second set. See examples of both.

To execute the **One Set** variation, with the **Intersection** tool active and the ***shift*** key pressed, click on the objects. Then release the ***shift*** key and click anywhere in the project window to complete the operation. To execute the **Two Sets** variation, pick the first set as above and then continue and repeat the process to pick the second set. The operations is executed as soon as you release the ***shift*** key and click in an open area of the project window.



(a) Original objects
and (b) their intersection.



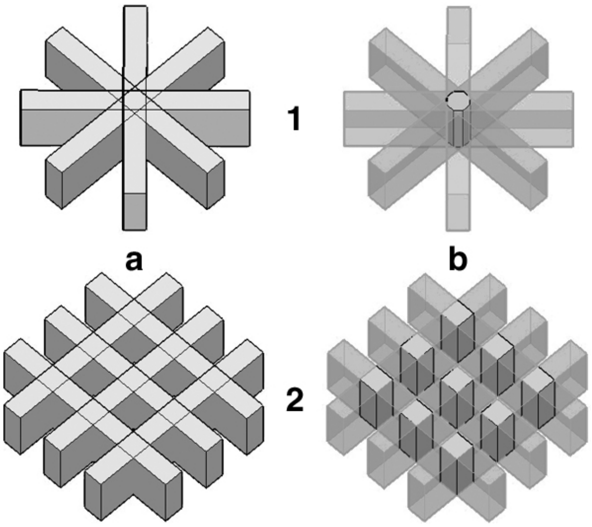
Tool Options – Intersection

● One Set

○ Two Sets

☐ Keep Edges

The Intersection tool options palette.

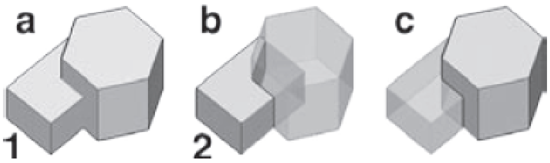


(1) One Set and (2) Two Sets intersections.
(a) Original objects and (b) results.

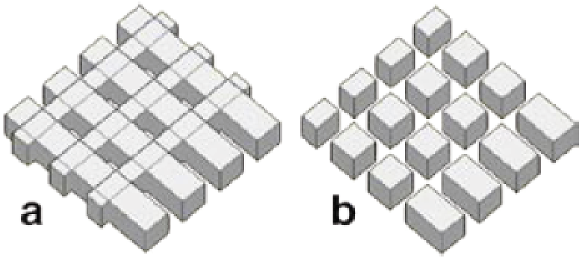
Difference

This tool subtracts the volume of one object from the volume of another, provided the two objects overlap. To apply the operation, with the tool active click on the two objects, where the order is significant, as the second object is subtracted from the first.

The operation can also be applied to sets of objects, where the second set is subtracted from the first. The sets are picked as for the **Two Sets** intersection. See example.



(a) Original objects.
Difference of (b) 1-2 and (c) 2-1.

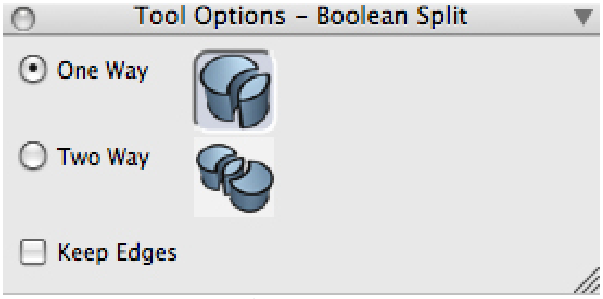


Difference of object sets:
(a) Original objects. (b) Result.

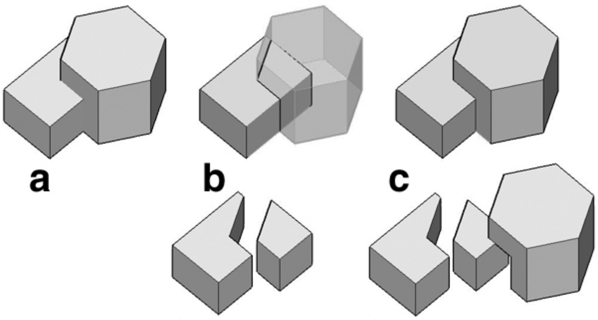
Boolean Split

This tool splits one object by another or two objects split each other, provided they overlap. Which variation is applied (**One Way** or **Two Way**) is set in the tool options palette. In more formal terms, this operation is a combined difference and intersection. See example.

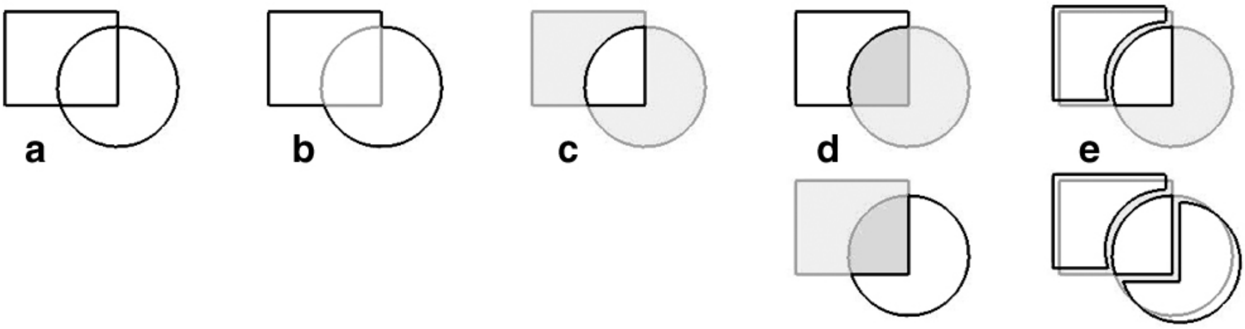
All the **Boolean** operations can be applied to solids or to coplanar closed 2D shapes. For the latter, see the shown examples. They cannot be applied to wires or arbitrary surfaces.



The Boolean Split tool options palette.



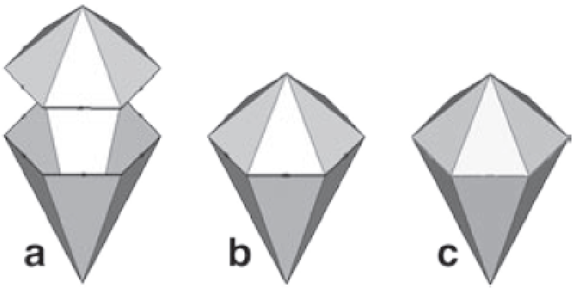
(a) Original objects. (b) One Way and (c) Two Way splits.
In lower row pieces have been moved to be able to see them.



Booleans applied on 2D shapes: (a) original objects, (b) union, (c) intersection, (d) differences, and (e) Boolean splits.

Stitch

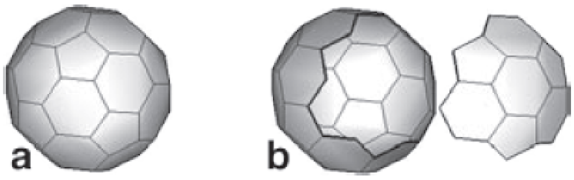
A stitch is the sequence of edges where faces meet and are linked to form a surface. Sequences of edges of two distinct objects may coincide but not be linked as stitches. This tool is used to link such sequences of edges. To apply it, with the tool active click on the two objects that are to be stitched, The result is produced immediately. See example.



(a) Two pyramids with open bases.
(b) Open bases placed to touch.
(c) Stitching them makes a solid.

Unstitch

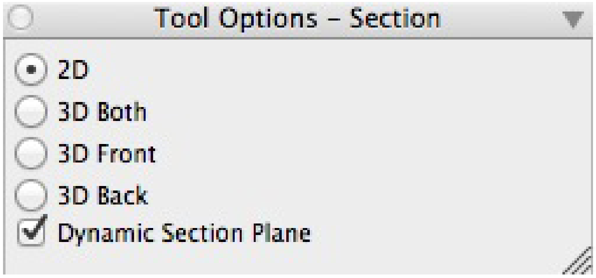
This operation is the opposite of stitching. It separates one or more groups of faces from the original object. To apply it, with the **Unstitch** tool active and while pressing ***shift***, select the faces you wish to separate from the object. Then release ***shift*** and click in an open area of the project window. The operation is executed immediately, however, unless you have the **Show Directions** option on, you will not be able to tell the difference, until you actually move the faces you unstitched, as in the example.



(a) A soccer ball.
(b) After selecting seven faces we applied Unstitch. Then moved the faces that were separated.

Section

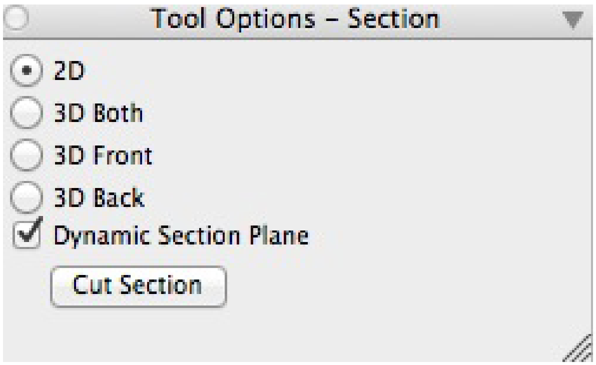
This tool is used to derive 2D or 3D sections of objects or multiple objects. What it does is determined by the option selected in its tool options palette. The **2D** option generates a planar 2D section. There are three 3D options. They all initially generate the same section but they vary in terms of what they return as a result. **3D Both** returns both front and back pieces, **3D Front** and **3D Back** return the front or back piece only.


Tool Options – Section
● 2D
○ 3D Both
○ 3D Front
○ 3D Back
☑ Dynamic Section Plane

The Section tool options palette before a dynamic section is initiated.

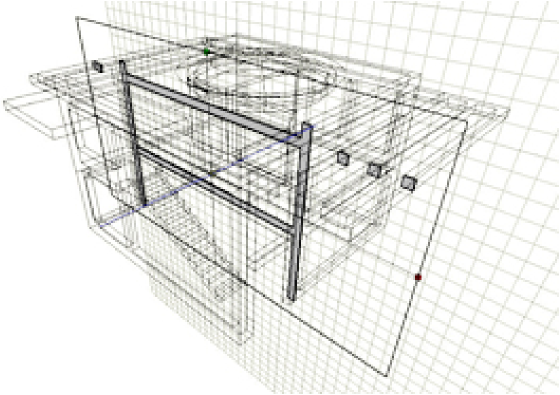
The section operation can be applied either dynamically or directly. The dynamic operation allows the section plane to be adjusted as needed during the operation, while a direct section allows an arbitrary face or plane to be specified and the operation is excuted immediately.

To apply the operation dynamically, with the **Pick** tool select the objects you wish to section, then, with the **Section** tool click in the project window. The outline of a cutting plane parallel to the currently active reference plane appears with its controls and is rubber banded. You can manipulate the controls to move and/or rotate the cutting plane. As you do this the displayed result of the operation is refreshed and always displays the section at the current position of the cutting plane.


Tool Options – Section
● 2D
○ 3D Both
○ 3D Front
○ 3D Back
☑ Dynamic Section Plane

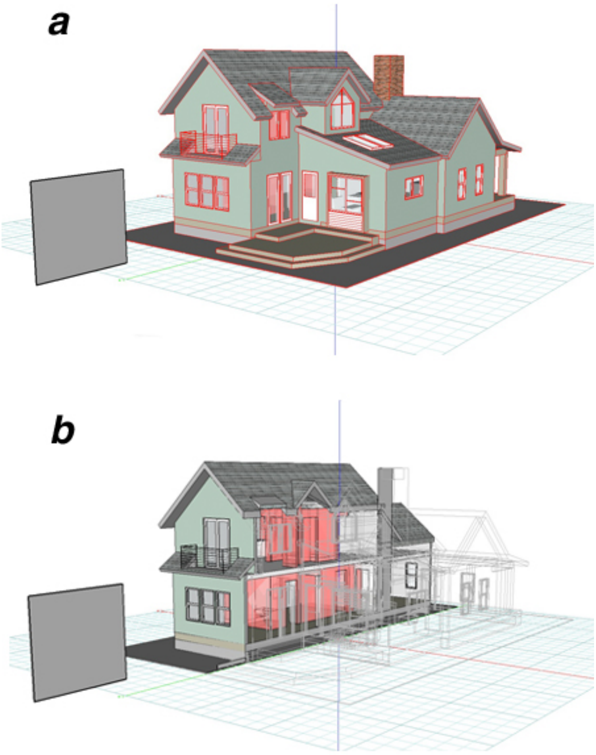
The Section tool options palette after a section plane has been specified, with the Cut Section button shown.

The initial section is of the type selected in the tool options palette, which is 2D by default. While in edit mode, you can change your selection in the tool options palette and switch from 2D to 3D and vice versa. Also you can switch between the three variations of the 3D sections. When satisfied with the result currently displayed, click **Cut Section** and the section operation is completed. The section is returned as a separate object or set of objects. If you exit the section tool by choosing a different tool, you will be asked if you want to complete the current section operation or cancel it.

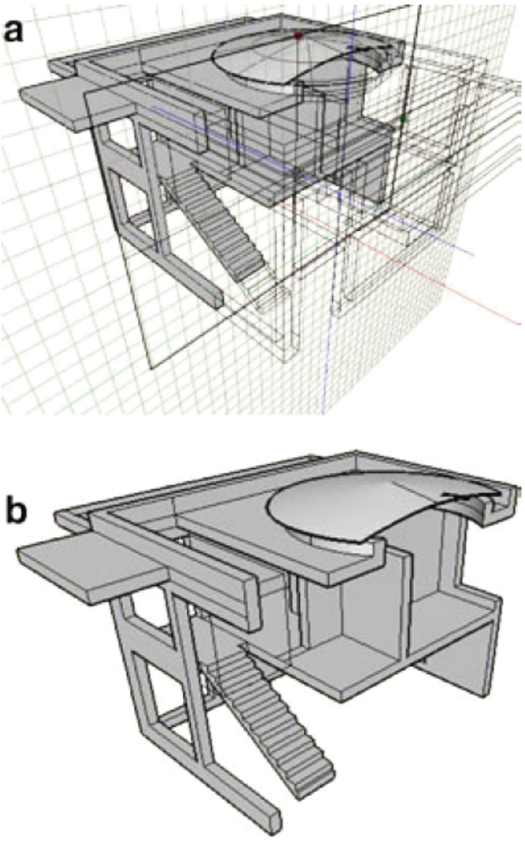


A dynamic 2D section.

To apply the operation directly, with the **Pick** tool select the object to be sectioned, and then click on any selectable face in the project file. If the imaginary extension of this plane intersects the picked object, it will create the section at that location and immediately return the result. See examples of both dynamic and direct sections below.



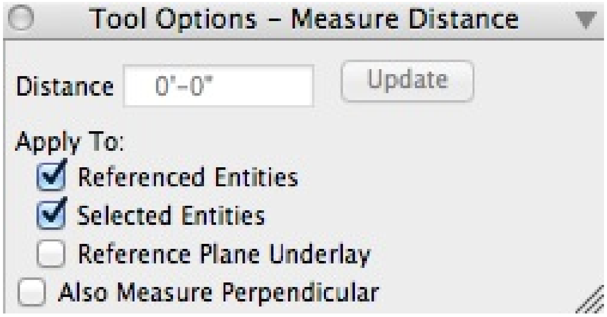
Direct 3D section: (a) objects prior to the section operation with arbitrarycutting plane and (b) the result.



3D section: (a) in edit mode and (b) the result.

Measure Distance

This tool measures distances between points. With the tool active click on the first point from which a distance is desired. A line is rubber banded and follows the motion of the mouse. A hint appears that displays the current distance from the first point. A second click completes the operation. If the **Also Measure Perpendicular** option is selected, a second measurement is performed from the first point perpendicular to either a segment reference plane or face.



Tool Options - Measure Distance

Distance 0'-0"

Apply To:

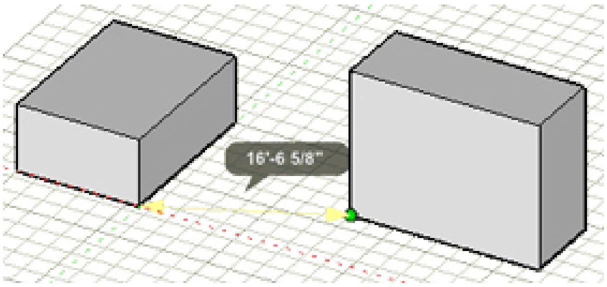
☑ Referenced Entities

☑ Selected Entities

☐ Reference Plane Underlay

☐ Also Measure Perpendicular

The Measure Distance tool options palette.

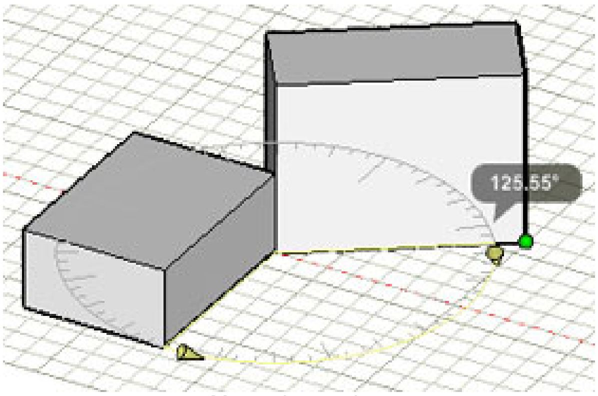


Measuring distances.

The **Measure Distance** tool can also be used to scale objects, billboards, and underlays. After the tool has been used to determine the distance between two points, you can enter a new value for the distance into the **Distance** field and then click the **Update** button to scale the entity. The value will be applied to the entity between the clicked points, and rest of the object will scale accordingly. This can be quite useful for scaling drawings that have been added to the file either as an underlay or as a billboard. If a single dimension on the drawing is known, the entire drawing can be scaled. The **Apply To**: checkboxes determine what type of entity the new scale will be applied to. **Referenced Entities** will apply the new scale to an object that the two scale points have been snapped to. **Selected Entities** will apply the new scale to all selected entities. It is useful to know that if you have not snapped the scale tool's endpoints to snappable points, as in the example of when a desired element is within the bounds of a drawing, then you must pre-pick the object and ensure that **Selected Entities** is checked. **Reference Plane Underlay** allows the new scale value to be applied to an **Underlay** image on any reference plane.

Measure Angle

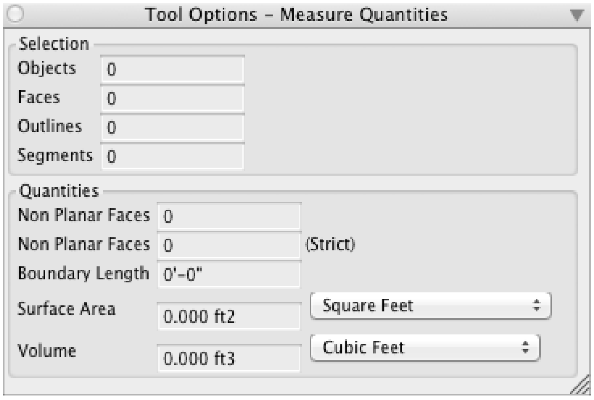
This tool measures angles. With the tool active, click on the apex point of the angle you want to measure, then on a point at the start of the angle. The current angle is displayed as you move the mouse. You may press the ***command*** (Macintosh) or ***control*** (Windows) key to display the complimentary angle. The next click completes the operation.



Measuring angles.

Measure Quantities

This tool is used to extract information about an object. With the tool active, click on the object in question. The information is displayed in the **Measure Quantities Tool Options** palette, which has two tabs: **Selection** and **Quantities**. If solid objects are selected, the combined center of gravity for all objects is shown by a point in the project window.



Tool Options – Measure Quantities

Selection

Objects 0

Faces 0

Outlines 0

Segments 0

Quantities

Non Planar Faces 0

Non Planar Faces 0 (Strict)

Boundary Length 0'-0"

Surface Area 0.000 ft2 Square Feet

Volume 0.000 ft3 Cubic Feet

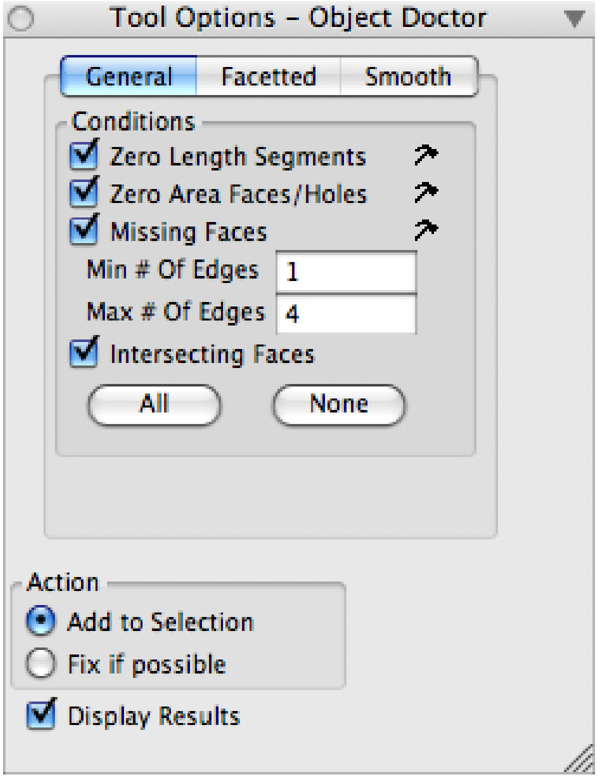
The Measure Quantities tool options palette:
(a) Selection and (b) Quantities tabs.

Object Doctor

This tool allows you to produce diagnostics about faults that an object may have and have them corrected, whenever possible. It is complemented by the **Tool Options** palette.

The palette contains three tabs: **General**, **Facetted**, and **Smooth**, each of which contains a number of faults applicable to the respective category. You turn on those items for which you wish the tool to check.

At the bottom of the palette is the Action group, which contains two options: **Add To Selection** and **Fix If Possible**. Selecting one of these options causes the tool to work either as a diagnostic mechanism or as a repairer. The option **Display Results** does just that, when on.

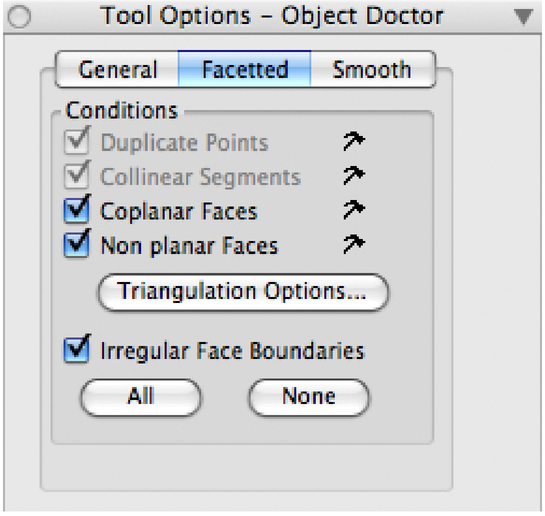


Conditions
☑ Zero Length Segments
☑ Zero Area Faces/Holes
☑ Missing Faces
Min # Of Edges 1
Max # Of Edges 4
☑ Intersecting Faces

Action
● Add to Selection
○ Fix if possible

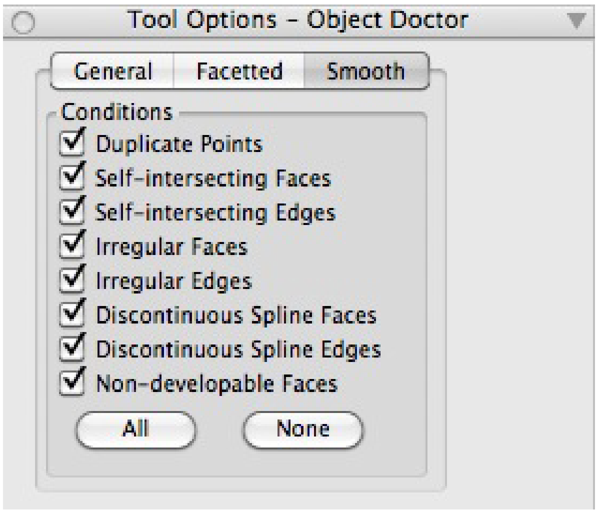
☑ Display Results

The Object Doctor Palette, General Tab



Conditions
☑ Duplicate Points
☑ Collinear Segments
☑ Coplanar Faces
☑ Non planar Faces
☑ Irregular Face Boundaries

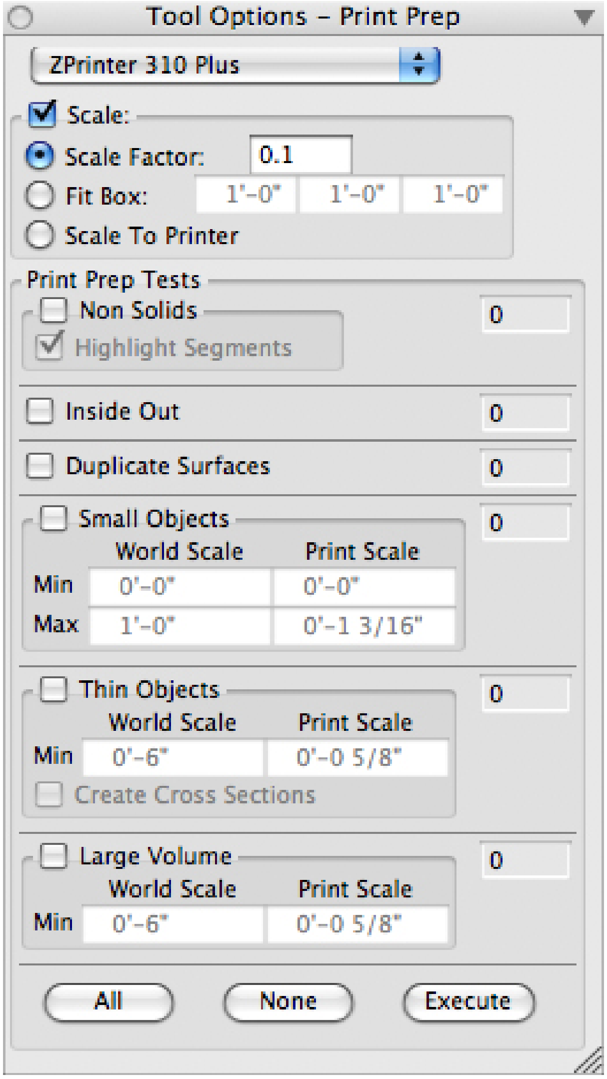
The Object Doctor Palette, Facetted Tab



Conditions
☑ Duplicate Points
☑ Self-intersecting Faces
☑ Self-intersecting Edges
☑ Irregular Faces
☑ Irregular Edges
☑ Discontinuous Spline Faces
☑ Discontinuous Spline Edges
☑ Non-developable Faces

The Object Doctor Palette, Smooth Tab

Print Preparation


Tool Options – Print Prep

ZPrinter 310 Plus

☑ Scale:

● Scale Factor: 0.1

○ Fit Box: 1'-0" 1'-0" 1'-0"

○ Scale To Printer

Print Prep Tests

☐ Non Solids 0

☑ Highlight Segments

☐ Inside Out 0

☐ Duplicate Surfaces 0

☐ Small Objects 0

	World Scale	Print Scale
Min	0'-0"	0'-0"
Max	1'-0"	0'-1 3/16"

☐ Thin Objects 0

	World Scale	Print Scale
Min	0'-6"	0'-0 5/8"

☐ Create Cross Sections

☐ Large Volume 0

	World Scale	Print Scale
Min	0'-6"	0'-0 5/8"

The Print Preparation tool options palette.

This tool detects and highlights potential 3D printing problems. No attempt is made to correct any of the problems, this correction is left to the user.

This tool applies to the whole project and any prepicked objects are of no significance. When you activate the tool, the **Print Prep** tool options palette is invoked, where you set the conditions you wish to be checked. Then you click anywhere in the project window. The program highlights those objects that fail the conditions you have set.

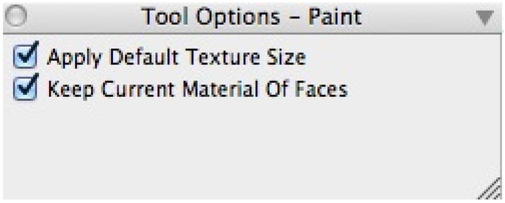
With some of the conditions you are required to enter distances in both world and print scale. ***World*** units are the ones used in the project. ***Print*** units are those derived after the scale set at the top of the options palette is applied. These represent the size of the actual physical model that will be 3D printed.
At the top of the palette there is a pop-out menu for selecting the device to be used for the 3D printing.

Different devices may have different requirements. It is followed by the **Scale** group. There are three methods for scaling: entering a **Scale Factor**, defining a **Fit Box** that limits the size of the model, and **Scale To Printer** that causes the model to be scaled according to the picked printer.

The conditions for which the model can be checked are: **Non Solids**, **Inside Out**, **Duplicate Surfaces**, **Small Objects**, **Thin Objects**, and **Large Volume**. When **Thin Objects** is checked, you can also instruct the program to **Create Cross Sections** parallel to the reference plane, which helps to better visualize the problem areas of the object. The **Large Volume** check is useful for saving material. When an object is found to be too bulky, it can be hollowed to save the material that would have otherwise taken to 3D print it as a solid.

Two buttons at the lower end of the palette, **All** and **None**, turn all checks on or off respectively. The **Execute** button has the same effect as clicking in the project window to execute this tool.

Paint



Tool Options – Paint

☑ Apply Default Texture Size

☑ Keep Current Material Of Faces

The Paint Tool Options palette.

Objects are assigned the active material when they are generated. That material can be changed using the **Paint** tool. With the tool active, click on an object or a face. The object or the face receives the material that is currently active in the **Materials** palette.

The prepick method can also be used to paint multiple objects. The **Paint** tool options palette has two options:

Apply Default Texture Size: Placed textures may be edited and their sizes changed. When replaced with other textures, the new textures adjust to the previous sizes, unless this option is on, when the default sizes are used.

Keep Current Material of Faces: When this option is selected, the new color is applied to the object only, and the previously individually colored faces keep their color.

Ghost

This tool is used to turn an object into a ghost. With the tool active, click on an object. The previously active object is ghosted immediately. The prepick method can also be used: prepick a number of objects using the Pick tool and then, with the **Ghost** tool active, click anywhere in the project window. All prepicked objects are ghosted.

A ghosted object is a temporarily inactive object that retains all its properties but cannot be picked and be involved in an operation. It can only be picked by the **Unghost** tool (see next paragraph). While this tool can be used to directly ghost an object, objects may also be ghosted after they are involved in some operation. Ghosted objects may or may not be displayed, which is controlled by the **Hide Ghosted** option in the **Display Options** palette for **Wire Frame** and **Shaded Work** mode. When displayed, ghosted objects are shown in a different color from the active objects, which, by default, is light gray. This color can be customized from the **Project Settings** dialog invoked from the **File** menu.

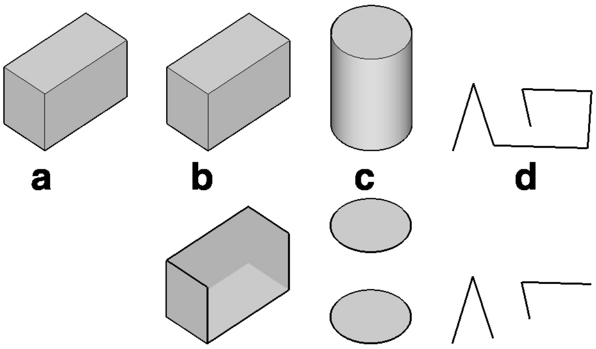
Unghost

This tool is used to reactivate ghosted objects. With the tool active, click on the ghosted object you wish to unghost. This tool is the only tool capable of picking ghosted objects, when they are displayed.

Deleting

Delete

This tool is used to delete complete objects or parts of objects. It can also be used to delete lights, guides, views, and controls of spline curves and surfaces. It can be executed in either postpick or prepick mode. Recall that to pick parts of objects, the command (***Macintosh***) or ctrl (***Windows***) key is used.



Deleting complete objects or parts of objects.

Shown on the top row of the example to the right are the original objects, and on the lower row, the results. In (a), the whole object was deleted. In (b), the segment marked with a bullet was deleted. In (c), the round face of the cylinder was deleted. In (d), a point of the vector line was deleted, which caused two segments to be deleted and the vector line to be broken in two.

Note that any entity that can be deleted with this tool can also be deleted using the delete key on the keyboard. Use the **Pick** tool to select any number of entities, then press ***delete***. All selected entities are deleted.

Assigning and Editing Textures

In **form•Z** a material that is assigned to an object or face may contain a texture map, such as the image of a brick wall or wood boards. The process of texture mapping determines how this inherently 2D texture is placed on a 3D shape. The following mapping types are used to achieve this:

Flat: The texture is projected onto the object/face along a linear direction. This is not unlike a slide projector putting an image on a screen. If the projection direction is perpendicular to a flat surface, the texture appears undistorted.

Cubic: The texture is projected as in the flat mapping type, except that each surface chooses the closest of 6 directions, corresponding to the 6 sides of a cube that surrounds the surface.

Cylindrical: The texture is projected from an imaginary cylinder that surrounds an object inward toward the cylinder axis.

Spherical: The texture is projected from an imaginary sphere that surrounds an object inward toward the center of the sphere.

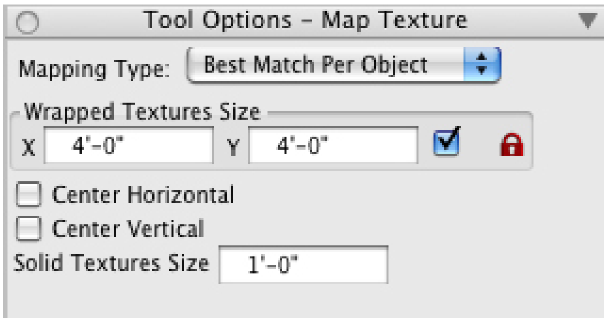
Parametric: The texture is aligned with the direction of a parametric surface. For example, in a nurbs surface, the horizontal direction of the texture will be aligned with the length (U) direction and the vertical direction of the texture will be aligned with the depth (V) direction of the surface.

UV Coordinates: One of the above mapping types can be converted to UV coordinates mapping. When this occurs, the texture will be frozen at the points of the object. Initially it will look the same as the mapping type it was derived from. However, if the points of the object are moved, the texture sticks to the points and appears to stretch with the moved point.

When an object is first created, the type of mapping that best suits its shape of is automatically assigned to it. For example, nurbs objects receive the parametric mapping type. A cube receives cubic mapping. An extruded wall receives separate flat mapping on each of its vertical faces, so that the texture is projected perpendicular on each face.

The default texture mapping assignments can be changed and edited with two tools. The **Map Texture** tool allows you to assign a different mapping type to an object or its face. The **Edit Texture** tool is used to interactively adjust the orientation and size of the texture.

Map Texture



○ Tool Options – Map Texture

Mapping Type: Best Match Per Object

Wrapped Textures Size

X 4'-0" Y 4'-0" ☑

☐ Center Horizontal

☐ Center Vertical

Solid Textures Size 1'-0"

The Map Texture Tool Options palette.

When an object is created it receives a default texture mapping type. With the **Map Texture** tool a new mapping type can be assigned to a whole object, or individual faces. This can be done using either the prepick or the postpick method of picking.

With the prepick method, use the **Pick** tool to select the objects and/or faces whose texture mapping needs to be adjusted. Then, with the **Map Texture** tool active, select the mapping type and other parameters in the **Tool Options** palette.

With the postpick method, activate the **Map Texture** tool and with it first select the objects and/or faces, then the texture mapping and other parameters in the **Tool Options** palette.

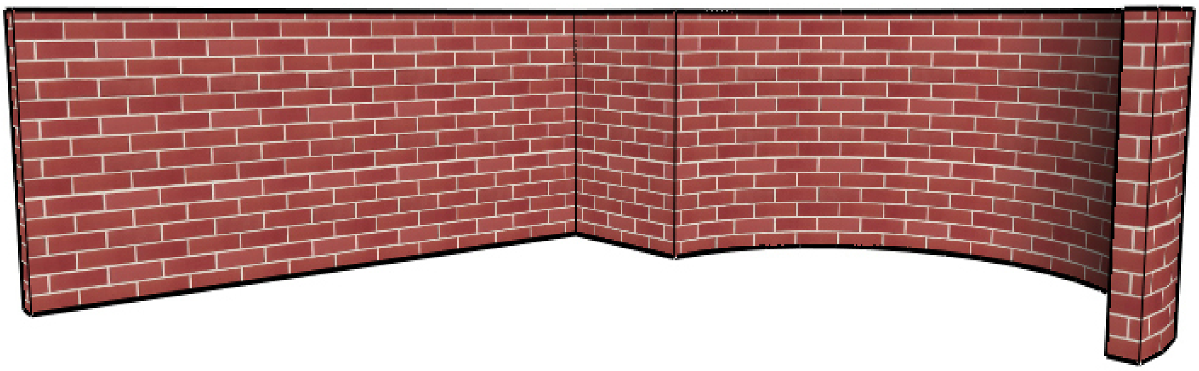
After the selections have been made, click anywhere in the project window and the selected parameters are applied to the objects/faces. If the objects are displayed without a texture map, no visible changes occur. It is therefore best to first apply a surface style that uses a texture to the object and to also enable the **Textures** option in the **Display Options** palette for the **Shaded Work** and **Shaded Full** rendering modes.

The **Mapping Type** menu in the Tool Option palette offers the basic mapping types **Flat**, **Cubic**, **Cylindrical**, and **Spherical**. They behave as described previously. In addition it offers two more options:

Best Match Per Object: When this menu item is selected, the texture mapping type that bests suits a selected object is used. This is the same mechanism that is applied when an object is first created.

Best Match Per Face: With this menu option, an individual mapping is applied to each face of an object.

Planar faces receive a flat mapping type, that keeps the vertical texture direction aligned with the world Z axis (i.e. up) as much as possible. Completely horizontal faces show the horizontal texture direction aligned with the world X axis. Cylindrical faces receive cylindrical mapping and spherical faces spherical mapping. All other face types receive cubic mapping. This mapping type works well on architectural elements, such as walls and roofs as it aligns the texture representing the building material (bricks, shingles) with the natural direction of the surface. An example of a wall with straight and curved components is shown. Note how the texture follows along the wall surfaces.



Brick texture mapped on a wall after the Best Match Per Face option was selected.

The **Tool Options** palette also contains a **Wrapped Textures Size** parameter. This is the real world dimension that corresponds to one placement of the texture. For example, if a texture map of a brick pattern consists of 5 bricks horizontally and the bricks are 8 inches long, the size parameter should be set to 40” in order for the brick texture to appear accurate. It should be noted that it is not critical that this parameter is set correctly right from the beginning, as the **Edit Texture** tool allows you to later fine tune the sizes of the textures.

Edit Texture

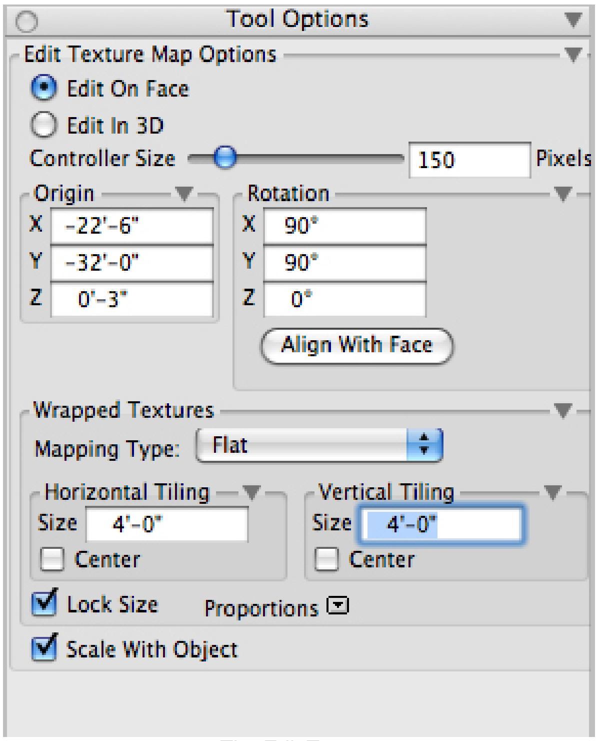
With the **Edit Texture** tool, the location, rotation, and size of a texture can be edited interactively. As with the **Map Texture** tool, it is best to first assign a material with a texture map to an object and enable the **Texture** option for the shaded display modes (**Shaded Work, Shaded Full**). With the **Edit Texture** tool active, select one face. This causes on-screen controls to be displayed. You can now click on these controls to interactively edit the location, size, and/or rotation of the texture. As you do this, the values of the parameters you are changing are displayed in the **Tool Options** palette. Alternatively, you can numerically change values of the parameters and these changes will be reflected in the graphic display.

The on-screen editing of the controls can be performed in two different ways, which are determined by options selected from the **Tool Options** palette.

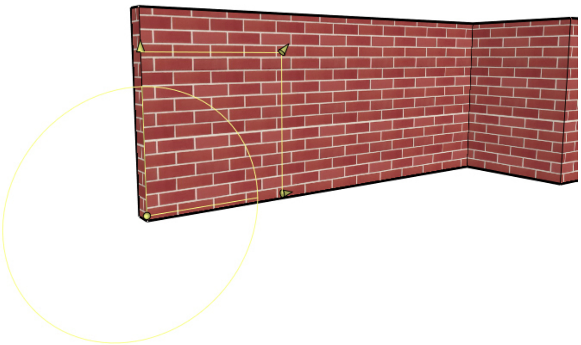
Edit On Face: When this option is selected, which is the default, the editing of size, location, and rotation of a texture occurs on a flat, cylindrical, or spherical surface, depending on the mapping type. For example, for flat mapping, the controls allow movement of the texture only in the plane of the flat mapping.

Edit In 3D: When this option is on, the origin and rotation of the texture map are edited in 3D space. The on screen controls allow the origin to be moved anywhere in 3D and the circular controls allow rotation around the three orthogonal axes.

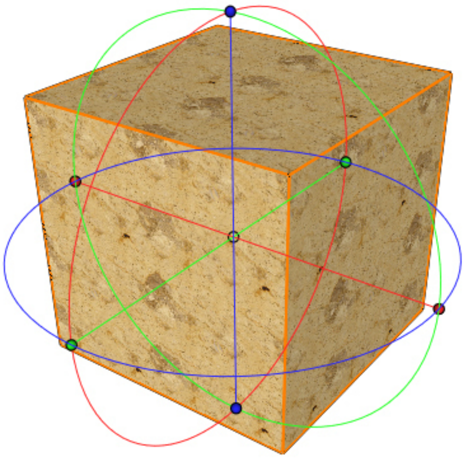
If a texture was assigned with the **Best Match Per Object** or **Best Match Per Face** option, it is usually not necessary to edit the texture in 3D, but simply adjust placement and size with the **Edit On Face** option.


Tool Options
Edit Texture Map Options
● Edit On Face
○ Edit In 3D
Controller Size 150 Pixels
Origin
X -22'-6"
Y -32'-0"
Z 0'-3"
Rotation
X 90°
Y 90°
Z 0°
Align With Face
Wrapped Textures
Mapping Type: Flat
Horizontal Tiling
Size 4'-0"
☐ Center
Vertical Tiling
Size 4'-0"
☐ Center
☑ Lock Size
Proportions
☑ Scale With Object

The Edit Texture
Tool Options palette.



The texture editing controls.



The Edit In 3D texture editing controls.

Depending on which texture mapping type is assigned to a face, the on screen controls of the **Edit On Face** behave differently:

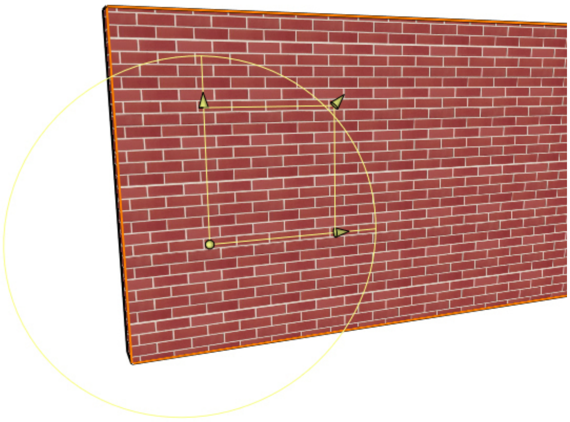
Flat:

Bullet: Changes the location on the plane of the flat map. It can be moved freely in any direction on that plane.

Axes: Moves the texture along the direction of the respective axis.

Ring: Changes the rotation of the texture on the plane.

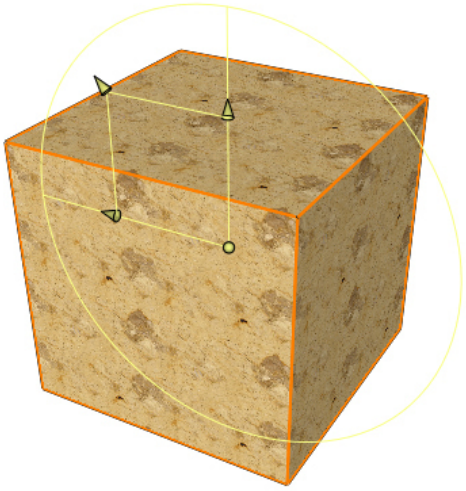
Arrows: Changes the size of the texture horizontally, vertically, or both.



The Edit On Face controls for Flat mapping.

Cubic:

As for **Flat** mapping. The plane in which the map is edited is one of the three orthogonal directions of the cube. Initially the selected face determines that plane. It can be switched by clicking on the XY, YZ, or ZX option in the **Tool Options** palette.



The Edit On Face controls for Cubic mapping.

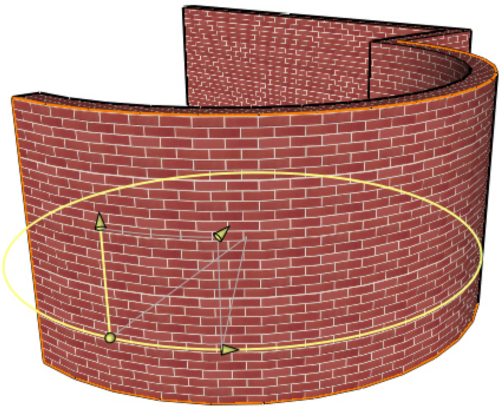
Cylindrical:

Bullet: Changes the location of the texture on the imaginary cylinder surrounding the face. It can be moved in any direction on the cylindrical surface.

Straight Axis: Moves the texture along the axis of the cylinder.

Ring: Moves the texture around the cylinder.

Arrows: Changes the size of the texture horizontally, vertically, or both.



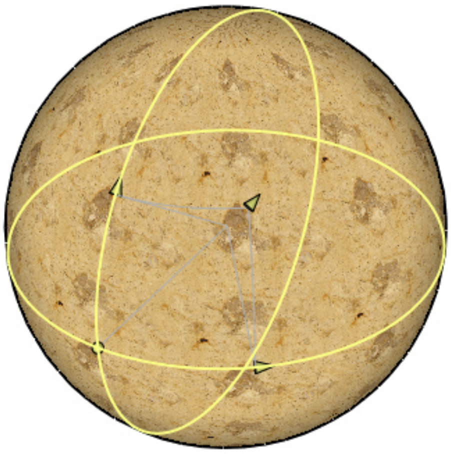
The Edit On Face controls for Cylindrical mapping.

Spherical:

Bullet: Changes the location of the texture on the imaginary sphere surrounding the face. It can be moved freely in any direction on the spherical surface.

Rings: Moves the texture along the ring direction.

Arrows: Changes the size of the texture horizontally, vertically, or both.

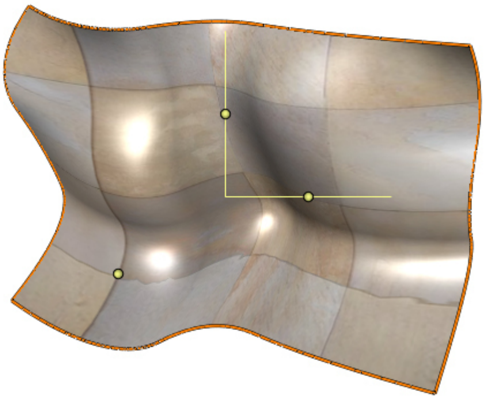


The Edit On Face controls for Spherical mapping.

Parametric:

Bullet: Changes the location of the texture on parametric surface. It can be moved freely in any direction on the surface.

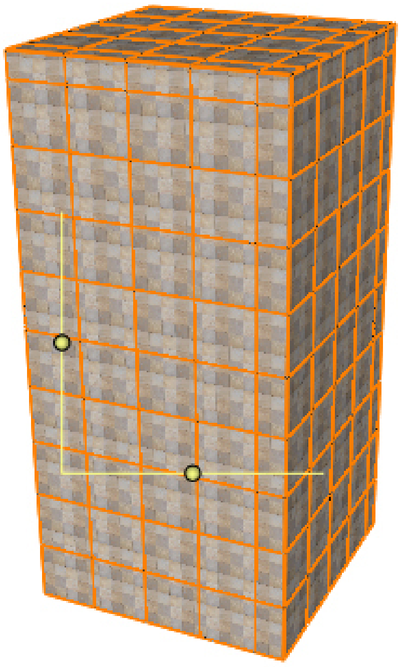
Sliders: Changes the size of the texture in percent.



The Edit On Face controls for Parametric mapping.

UV Coordinates:

Sliders: Changes the size of the texture in percent.



The Edit On Face controls for UV Coordinates mapping.

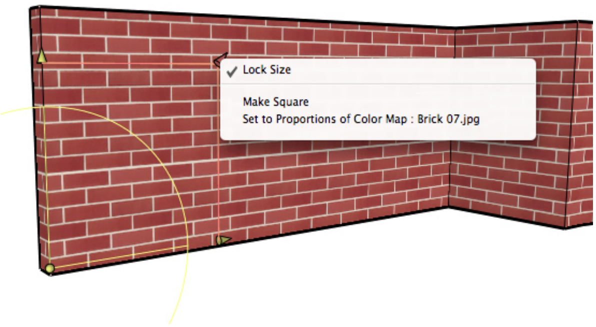
Useful hints

While editing the on screen controls, object snapping is enabled. This makes it easy, for example, to align a brick texture exactly with the edges of a wall and to orient the brick direction horizontally.

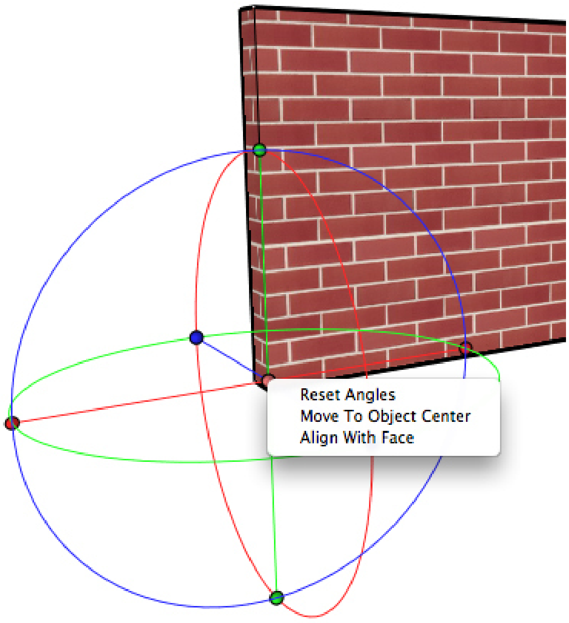
Clicking on any of the on-screen controls with the right mouse button invokes a **Context** menu.

When using the **Edit On Face** option, this menu allows you to lock the size of the texture to the current proportions (**Lock Size**), lock the size to square (**Make Square**), or lock it to the proportions of any of the textures used by the material on the face (**Set To Proportions Of Color Map**, **Set To Proportions Of Transparency Map**). Next time the texture is resized using the diagonal arrow, the proportions of the texture in 3D will be constrained according to the menu choice.

When using the **Edit In 3D** option, the **Context** menu provides shortcuts to set all angles to 0 (**Reset Angles**), to move the center of the texture map to the object center (**Move To Object Center**), and to align the axes of the texture map with the direction of the face (**Align With Face**).



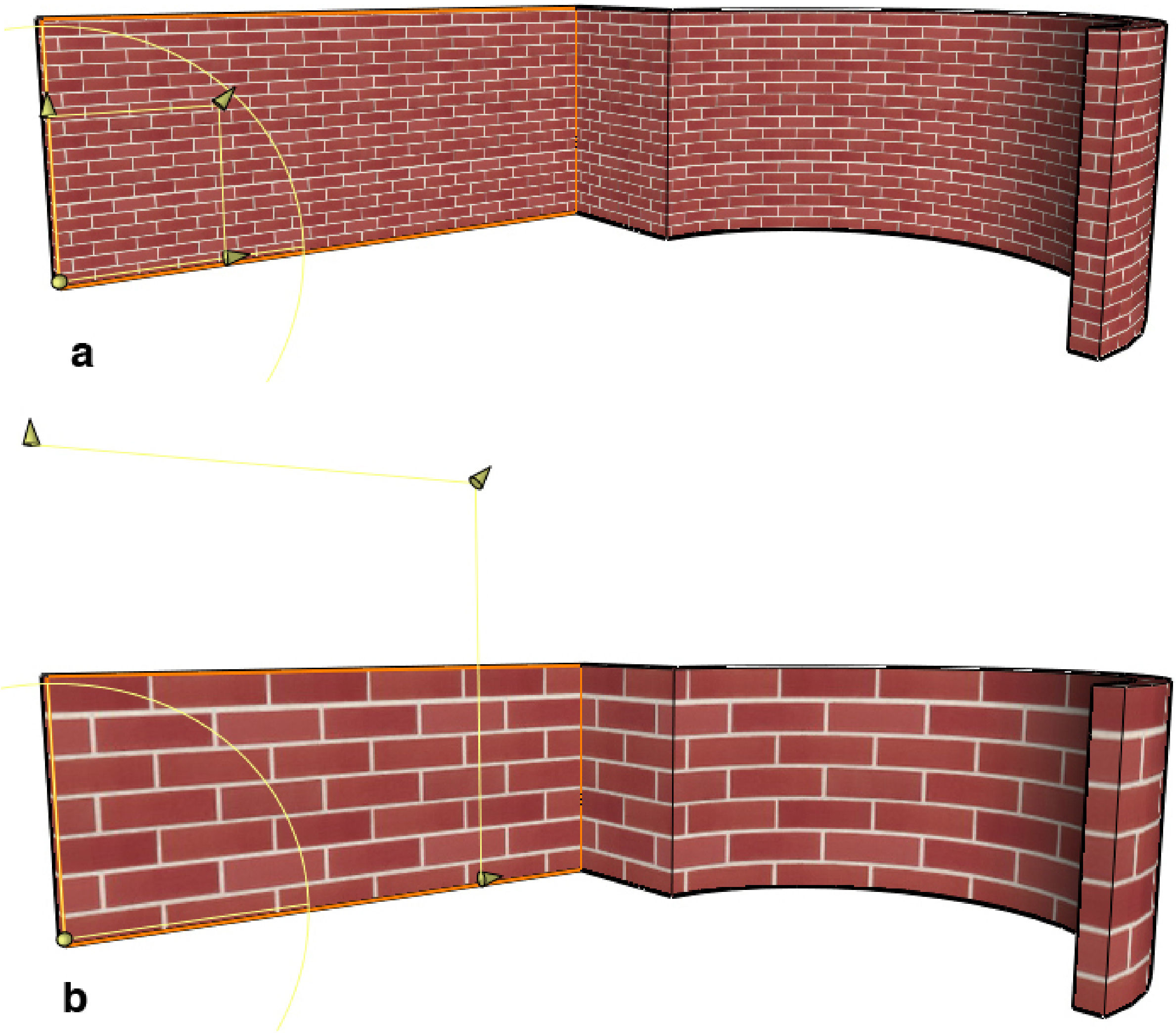
The Context menu invoked when right-clicking on a control, while Edit On Face is used.



The Context menu invoked when right-clicking on a control, while Edit In 3D is used.

When using the **Best Match Per Face** option and you are assigning textures to an object with the **Map Texture** tool, each individual face receives the appropriate texture mapping type. The **Best Match Per Object** option applies the same method, unless the object type chooses to use another, more appropriate mapping type. To make editing of textures on an object easier, the sizes of all individual texture maps are linked. That is, when editing the size of a texture map on one face of the object, the size of all other textures on the object change as well.

In the example below, a wall object with straight and curved components is created. A surface style with a brick texture is assigned. Next, the **Map Texture** tool is applied using the **Best Match Per Object** option. This creates individual texture mapping on each face, including the curved faces. Now the **Edit Texture** tool is used on one of the faces. The texture is resized with the diagonal arrow control. Note that the sizes of all faces of the object change, keeping the bricks the same. However, changing the location and rotation of the texture mapping on one face would not have affected the other faces.



(a) A surface style with a brick texture is mapped on the wall, using the Best Match Per Object option. (b) With the Edit Texture tool the texture of one face is resized, causing the size to be adjusted on all faces.

Creating and editing materials

Materials control the appearance of objects when thay are rendered in **form•Z**. They can be drug directly from the **Materials Palette** and dropped onto objects in the project window in order to apply them. All **Materials** that are in a project are displayed together in the **Materials** palette on the right side of the project window in the **Palette Dock**. One **Material** is active at any given time, and is highlighted with a red dot or a red border, depending on which view mode is in use. The currently active **Material** is assigned to all newly created objects. The **Materials Palette** also supports the grouping of **Materials**. **Materials** can be drug from any location in the palette and dropped into a **Material Group** to add it to the group.

The icons across the top of the palette control which type of display the **Materials** are shown in and allow access to further options.

● When in **List** view, as shown at upper right, the red dot in the upper left hand corner of the palette denotes a column beneath that will contain only one copy of the red dot in fornt of a **Material** at a time. This is the currently active material. As you create new objects, the **Active Material** will be applied to them.

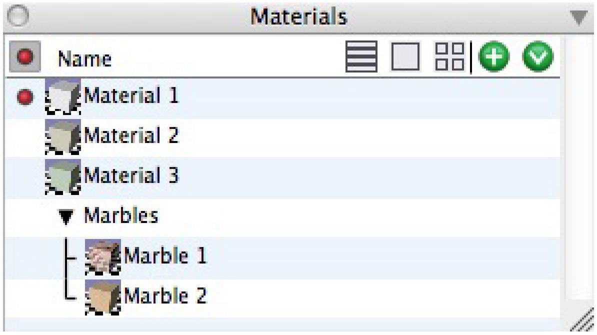
◀ When in either **Small** or **Large** icon view, this back arrow will return you to the smain **Materials** list or take you up to the next level in the group hierarchy if you are currently inside of a **Material Group**. This icon will be displayed in gray (◀) if there is no group above the current location, or if you are already at the topmost hierarchical level of the main **Materials** list.

□ Clicking this icon when in either **Small** or **Large Icon** view will make the current **Active Material** visible in the palette by displaying the group that the current **Active Material** is located in if it is not already displayed. This can make locating the **Active Material** easy if it is not currently visible and you are unsure of what group is in.

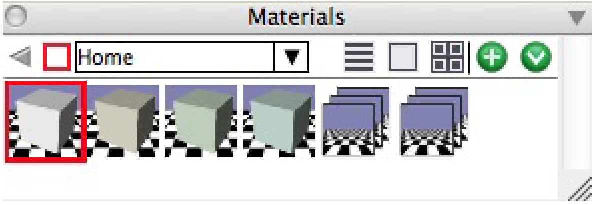
☰ This icon invokes the **List View**.

□ This icon invokes the **Large Icon View**.

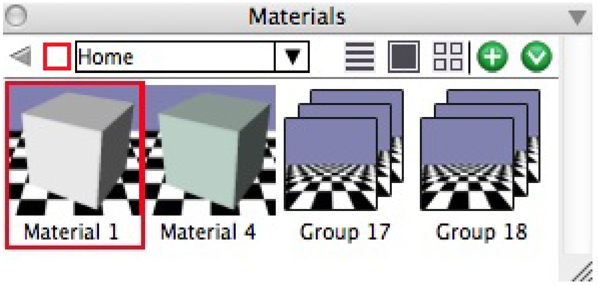
⊞ This icon invokes the **Small Icon View**.



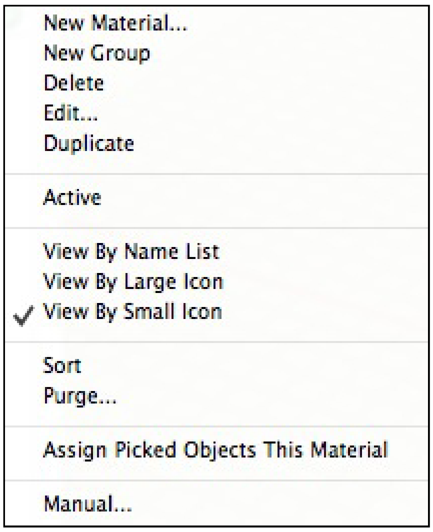
The Materials palette in List view with Material groups.



The Materials palette in Small Icon view with Material Groups.



The Material palette in Large Icon view with Material Groups.



The Material Palette drop-down menu.

⊕ This icon will create a new **Material**. This new **Material** will be added to the bottom of the palette.

⌄ This icon will reveal a list of contextual options. Some of them replicate the functions provided by the icons at the top of the palette. The menu items that have other functions are described below.

New Group: This menu item creates a new **Material Group**.

Delete: This menu item deletes the currently highlighted **Material**.

Edit...: This menu item will invoke the **Material Parameters** palette for the currently selected **Material** so that it's settings can be adjusted. The **Materials Parameters** palette is dicussed in the next section.

Duplicate: This menu item will create an exact copy of the currently selected **Material** and place the new **Material** at the bottom of the list palette. This is useful if you wish to make a new **Material** that shares a large number of similar settings, and you simply wish to tweak a few of them to modify the material's appearance.

Active: This menu item makes the currently selected **Material** the **Active Material**.

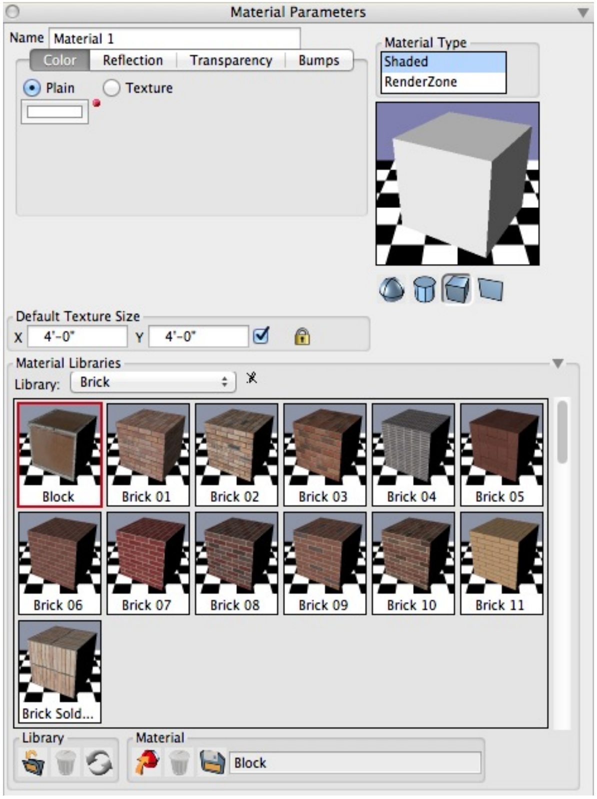
Sort: This menu item will sort the list of **Materials** in the palette alphabetically.

Purge...: This menu option will remove from the **Materials Palette** list any **Materials** that are not in use. In other words, if there are any materials that are in the materials list that are not applied to objects, these will be removed.

Assign Picked Objects This Material: This menu item will allow you to apply the currently selected **Material** to any objects that are currently selected in the project.

Manual: This menu item invokes the **form•Z** online manual and opens it to this page.

The Material parameters palette



Name Material 1

● Plain ○ Texture

Default Texture Size
X 4'-0" Y 4'-0" ☑

Library: Brick

Library
Material Block

Expanded Material Parameters palette.

Double clicking on the icon of an existing **Material** in the **Materials Palette** opens the **Material Parameters** palette. It displays the parameters that allow you to fine tune the appearance of the **Material** when rendered on an object. Clicking on a different icon in the **Materials** palette will select that material as the active material and display its parameters in the **Material Parameters** palette. By default, the parameters shown in the palette represent a generic material. The parameters allow you to apply a **Color**, which can be **Plain** or a **Texture** map. You can also set a **Reflection** and/or **Transparency**, which can be linear or derived from a transparency map. You can also assign a Bump map. This is usually a grayscale image designed to produce surface detail. Using the **Material Parameters** a number of effects can be simulated, such as plastic, glass, or wood. A preview of the material is shown at the right side of the palette, and the **Material** has been applied to a primitive and rendered. You may change the primitive that is used for the preview by clicking on the sphere, cylinder, cube, or plane beneath the preview window.

Default Texture Size: These parameters determine how large a texture will appear on an object, when the material is first applied. For example, if a texture shows a brick pattern with 5 bricks in 8 rows, the size should be set to 40″ x 18″, assuming a standard brick size of 8″ x 2 ¼″. This guarantees that the texture appears in its real world size on an object by default. The texture size on an object can be customized with the **Map Texture** and **Edit Texture** tools.

Choosing a predefined material

In addition to manipulating the parameters of the default material, a specific predefined material can be selected from a list of **Material Libraries**, displayed by expanding the **Material Parameters** palette, which is done by clicking in the open/close widget at the lower right corner of the palette. An expanded palette is shown.

At the top is the **Library** pop up menu from which a category of materials can be selected. The materials of the selected library are displayed below as icons. The parameters of one of those predefined materials can be applied to the current or other materials, using one of these ways:

1. Click on the **Apply** ( ) icon at the bottom of the palette.
2. Double click on the graphic icon of a predefined material.
3. Drag the graphic icon of a predefined material on top of the material preview window at the upper right corner of the palette.
4. Drag and drop a predefined material on top of a material icon in the **Materials** palette to apply its parameters to that material.
5. Drag and drop a predefined material on top of an empty spot in the **Materials** palette to create a new material.

Defining your own predefined materials

Form•Z comes with a large selection of predefined materials. However, you may also create your own selection of materials so that they can be used in future projects. The standard **form•Z** materials are stored as files in the **Form•Z Materials** folder, located in the same directory as the **form•Z** application folder. These materials and libraries cannot be altered. New user defined materials and libraries are saved to a folder also named **Form•Z Materials** in the user's documents folder.

To create a new user defined material, a new library must be created first by selecting **Add Library...** from the **Library** menu, or the default user library "My Library" may be selected. The parameters of the current material, as shown in the top portion of the **Material Parameters** palette, can be saved as a predefined material in three ways:

1. Click on the Save ( ) icon at the bottom of the palette.
2. Drag/drop the preview window on the predefined materials section.
3. Drag/drop a material icon from the **Materials** palette on the predefined materials section.

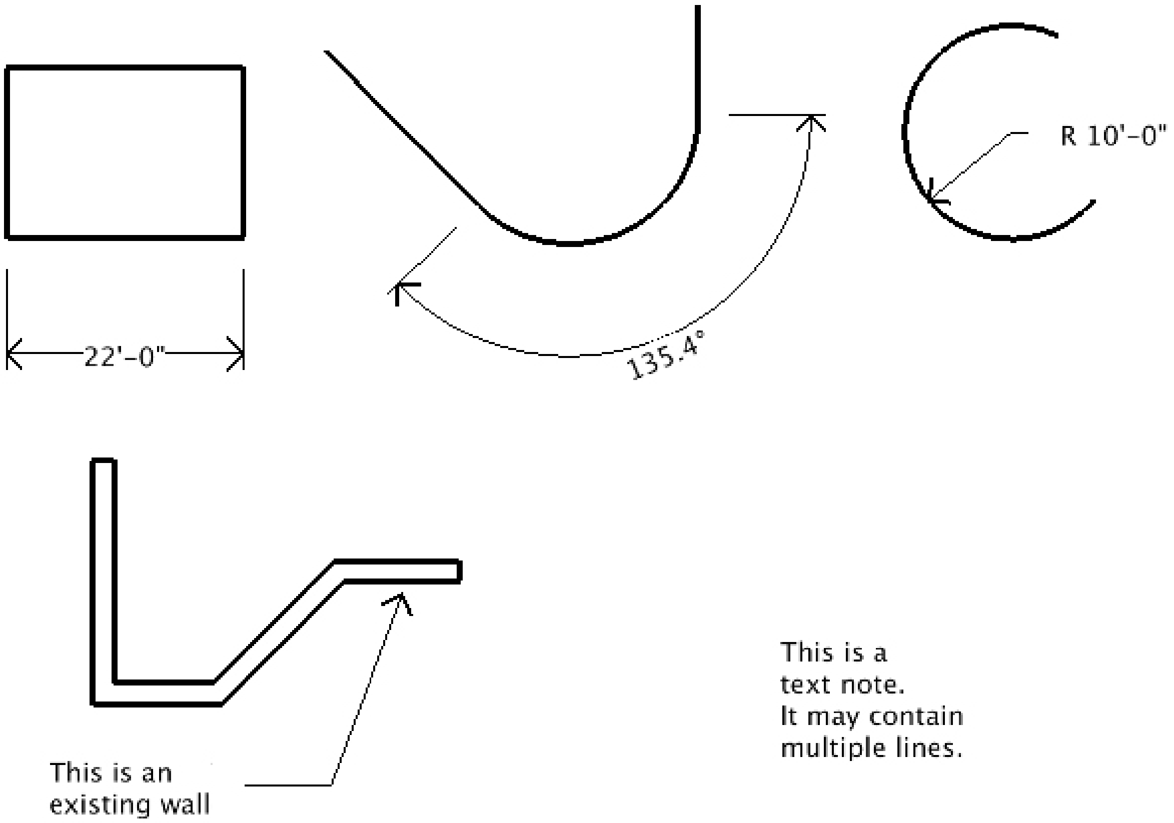
A previously created predefined material may be deleted by clicking on the **Delete** ( ) icon at the bottom of the palette.

Textures

Textures that are used in **Form•Z** are embedded in the project file when it is saved. This is so that if you transfer a file from one machine to another, the textures will still be available. This is a feature that helps in a pinch, but is not the intended method for routine work. Keeping your textures in a well-marked folder, preferably one that can be stored in the same folder as the project is highly recommneded. This feature, which is on by default, stores copies of the images internally, and makes the file size larger. There in an option to not keep copies of the images on a per project basis in the **Project Settings/Project Files**. There is also an option under **Project Files** that allows the user to specify the level of compression used when copies of the textures are kept in the file.

Dimensions

In **form•Z** you may add dimensions and text annotation to a 3d model. There are three kinds of dimensions: **Linear**, **Angular**, and **Radial**, and two kinds of simple text: **Leader Lines** and **Notes**. While the three dimensions automatically measure a physical quantity, such as a linear distance, leader lines and notes are used to add textual information to a model. An example of each is shown below.



Examples of the three types of dimensions, leader line, and note.

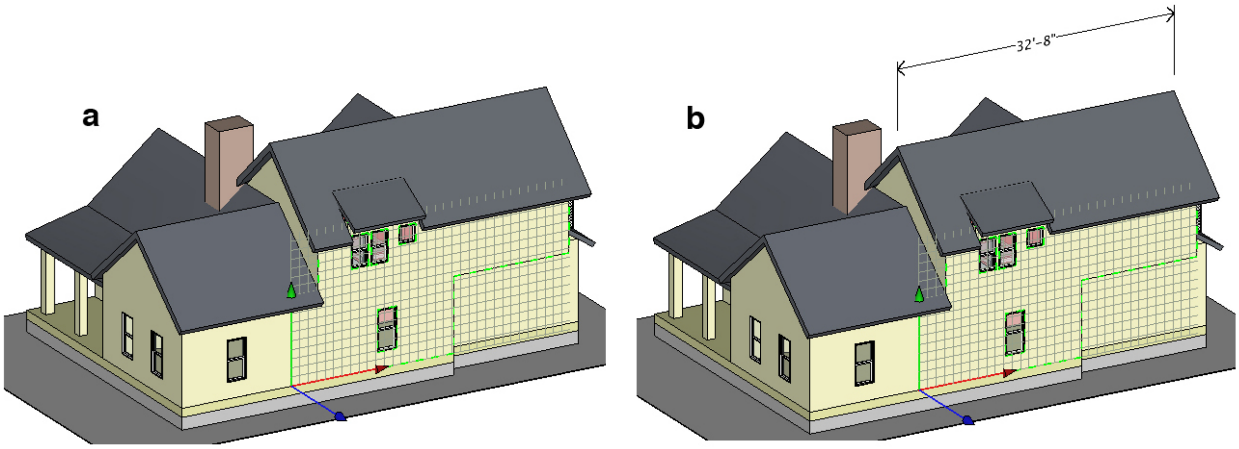
The tools to generate dimensions and text are located in the **Text** group of tools.

Linear Dimension

This tool creates a linear dimension from two clicked points or a selected segment. To generate a linear dimension from two points, click the first point in the model window. Make sure not to locate the mouse over a linear segment, as this will create the dimension from the segment (see below). After the first point is clicked, move the mouse to the location of the second point. The dimension value will be shown. Click the second point. Now the dimension text will be offset from the two clicked points. Click a third time to finish. Note, that this method works best when object snapping is on, which will cause the clicked points to be located exactly on a point of an existing object. However, it is not necessary to click on object points. A linear dimension can also be created from imaginary points anywhere on the reference plane.

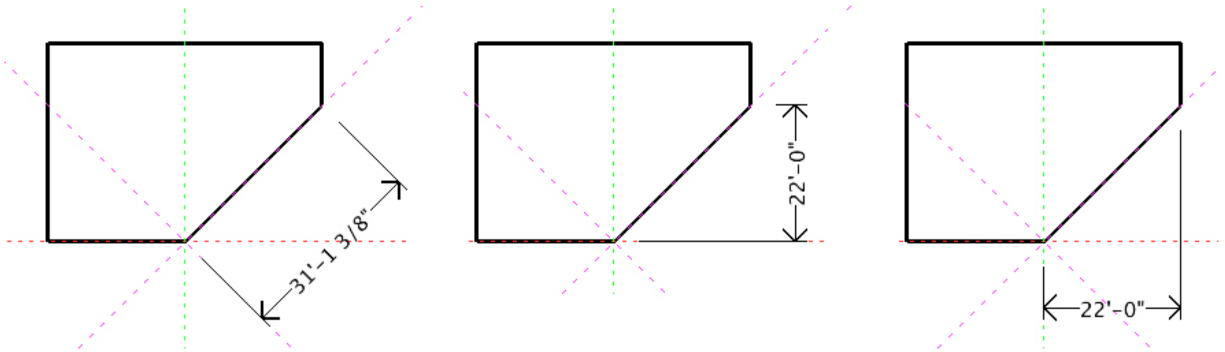
To create a linear dimension from a segment, select a straight segment. As soon as the segment is picked, the dimension text is offset as described above.

While clicking points or selecting the segment, the input plane is automatically adjusted to the face over which the mouse is located. This is the same mechanism that occurs when drawing shapes. Dimensions are displayed on a plane and the plane active after selection of the first point or segment will be the one used for the dimension. It is a good practice to move the mouse around until the desired plane is shown, then lock the plane using the ***f5*** key or the context menu. Subsequent clicks will no longer switch the plane. This is illustrated below.



Generating a dimension: (a) Choose and lock the plane.
(b) Click two points and extrude the dimension text on the plane.

Linear dimensions can be generated parallel to the clicked points/selected segment or parallel to the x or y axis of the current plane, as shown below. When extruding the dimension text, color coded guide lines are shown which indicate these three directions. Moving the mouse close to one of the three guides will change the extrusion to that direction.

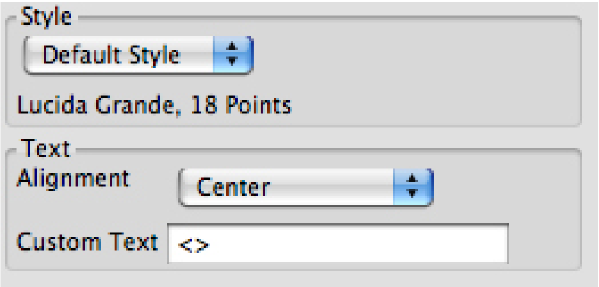


Types of linear dimensions: (a) parallel to the points,
(b) parallel to the x axis, and (c) parallel to the y axis.

After the dimension text has been extruded, the dimension is shown in the result highlight color. It is now possible to edit the parameters of the object through the **Tool Options** palette or by using the on screen controls, as with other objects. The **Tool Options** palette contains the following parameters:

Style: Select a dimension style from the menu or select Edit Styles... at the bottom of the menu to create new or edit existing styles.

Alignment: Select the desired alignment from the menu. If the dimension style shown in the **Style** menu above uses the **Aligned With Dimension** option, five alignments are available (see more details in the **Dimension Styles** section later on). If the style uses the **Horizontal On Screen** option, three alignments can be chosen. Examples of the alignments are shown in the figures below.



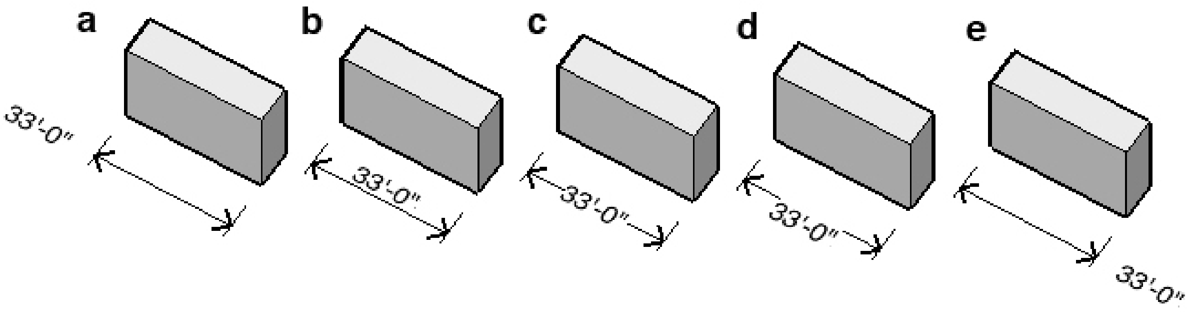
Default Style

Lucida Grande, 18 Points

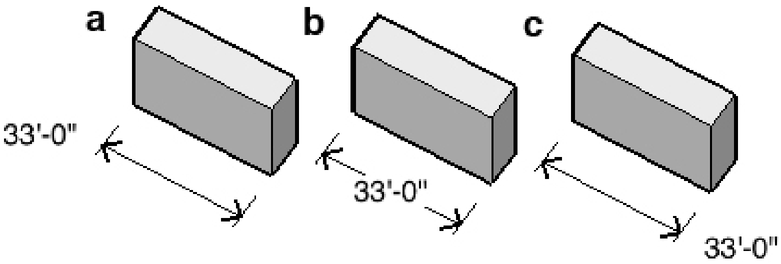
Alignment Center

Custom Text <>

The Tool Options palette for the Dimensions.



Alignment options for Aligned With Dimension styles: (a) At Start, (b) Center Inside, (c) Center, (d) Center Outside, and (e) At End.



Alignment options for Horizontal On Screen styles: (a) At Start, (b) Center, and (c) At End.

Custom Text: By default a linear dimension shows the distance between the two dimension points as text. The text can be replaced entirely, or additional text can be added in front and behind the distance. In the **Custom Text** field, the <> symbolizes the distance. If you delete these two characters and type in new text, it will be displayed instead. If you leave the <> characters and add additional text, it will be shown with the distance. For example, entering "This wall is <> long" will display "This wall is 10'-0 long" on the screen, assuming the two dimension points are 10 feet apart. If you type, "This is a wall", the dimension will show only that text.

Editing dimensions is discussed further in the **Picking and Editing Dimensions** section.

Angular Dimension

This tool creates a dimension that displays the angle defined by three points. As with the linear dimension you can either click points or select a segment. Three clicked points are required or the selection of an arc segment. When clicking points, the first click defines the center of the arc, the second the start point and the third the end point. The plane active when the first point is clicked will be the plane in which the dimension arc is generated. After the third click or the selection of a segment the dimension text is offset parallel to the defined arc. An additional click will finish the input. While offsetting the text, the arc can be reversed to display the complementary angle by tapping the ***command*** key (Mac) or ***control*** key (Windows). For example, if the arc shows 90 degrees, tapping the key will flip the arc to show 270 degrees.

The parameters for angular dimensions in the **Tool Options** palette are the same as for linear dimensions.

Radial/Diameter Dimension

This tool creates a dimension that displays the radius or diameter of an arc or circle. It is executed by picking a single arc or circular segment. After the pick, the dimension line is drawn from the click point on the arc to the current mouse position. An additional click will finish the input. The dimension text is preceded by the prefix “R” to indicate that the dimension shows a radius. You may switch the dimension to show the diameter by clicking on the respective radio button in the **Tool Options** palette. The prefix will now switch over to “Ø”.

As with linear and angular dimensions, radial dimensions use a style that determines how the text is displayed and which terminator is shown at the start of the dimension line. The text alignment can be set to **Top**, **Center**, or **Bottom**, which moves the text block relative to the end of the dimension line.

Leader Line

This tool creates a line at the end of which a text block is displayed. With the tool active click one or more points in the project. The first point will display the terminator, usually an arrow, pointing the part of the model for which the text description is intended. To end drawing the lines double click. Next a dialog will be displayed, where the text information can be entered. Note that long pieces of text will not automatically wrap when they are displayed in the project window. You will need to break long lines by hitting the return key when entering the text in the dialog. After exiting the text dialog the full leader line is displayed. Note, that the direction of the text block on the dimension plane is along the direction of the last line segment.

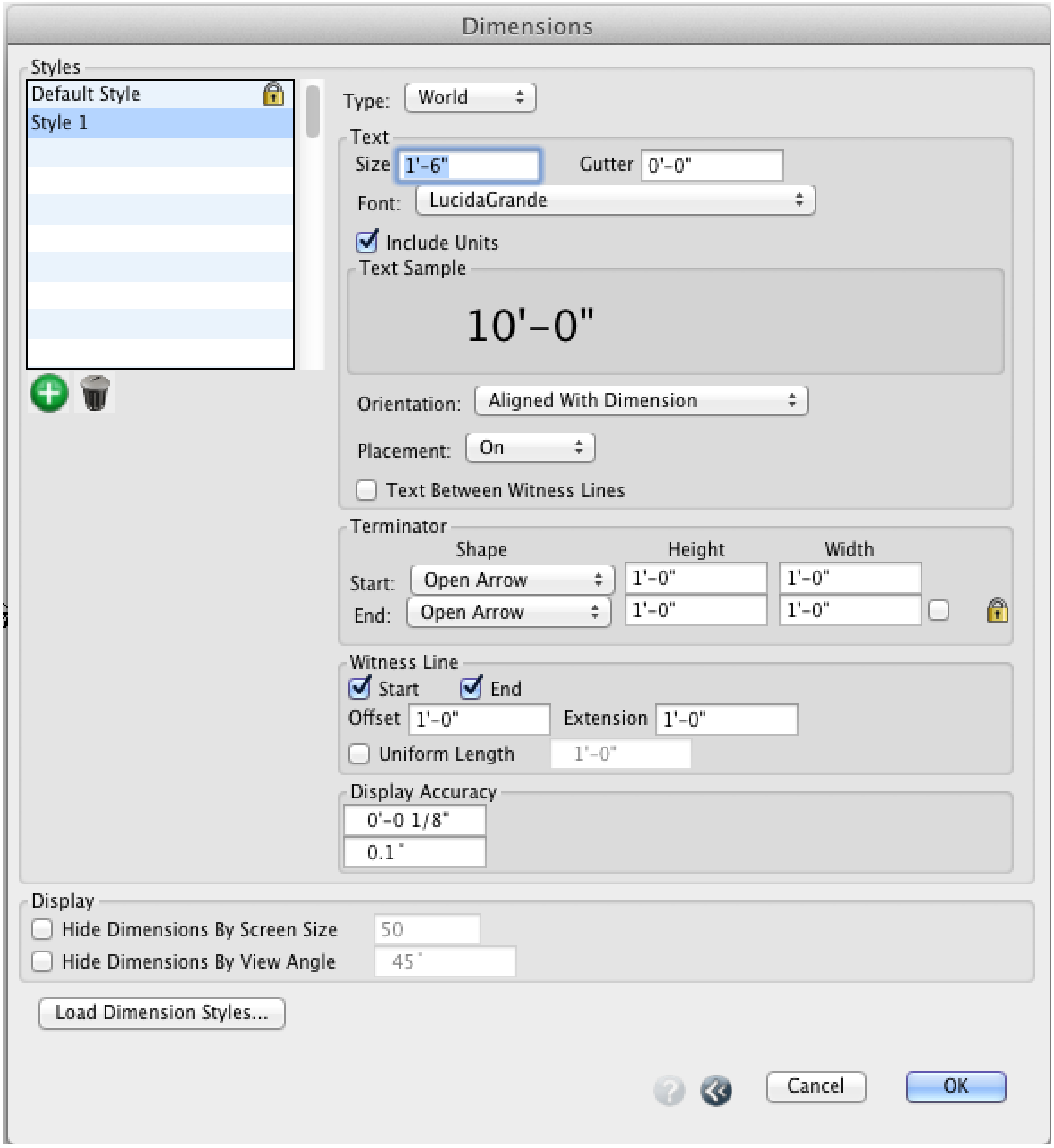
As with linear and angular dimensions, leader lines use a style that determines how the text is displayed and which terminator is shown at the start of the first line segment. The text alignment can be set to **Top**, **Center**, or **Bottom**, which moves the text block relative to the last line segment.

Text Note

This tool creates a simple block of text. With the tool active, click a point in the project. A dialog will be displayed, where the text information can be entered. As with leader lines, long text lines need to be broken by hitting the return key. After exiting the dialog, the text block will be displayed at the clicked point. The direction of the text is along the x axis of the reference plane, which was active at the time of the click. The direction of the text can be changed using the on screen controls.

Dimension styles

How a dimension or text is displayed is set by the style it uses. All the tools invoke a menu from which a style can be chosen. Initially there is one default style. By selecting **Edit Styles...,** more styles can be created in the **Dimensions** dialog. The same dialog can also be invoked from the **Dimensions** tab of the **Project Settings** dialog.



Type: World

Size 1'-6" Gutter 0'-0"

Font: LucidaGrande

☑ Include Units

10'-0"

Orientation: Aligned With Dimension

Placement: On

☐ Text Between Witness Lines

Start: Open Arrow 1'-0" 1'-0"

End: Open Arrow 1'-0" 1'-0" ☐

☑ Start ☑ End

Offset 1'-0" Extension 1'-0"

☐ Uniform Length 1'-0"

0'-0 1/8"

0.1"

☐ Hide Dimensions By Screen Size 50

☐ Hide Dimensions By View Angle 45°

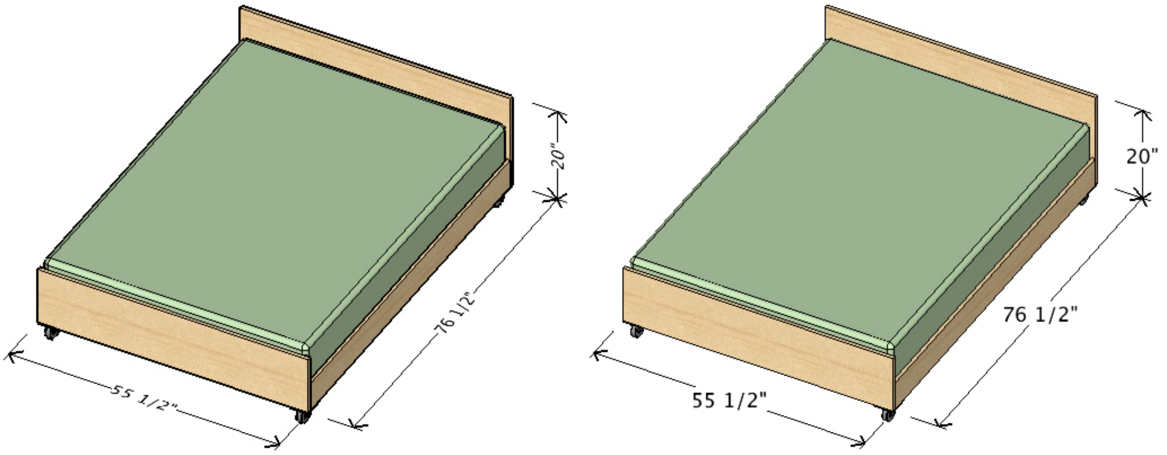
The Dimensions dialog.

On the left side of the dialog a list of available styles is shown. New styles can be created with the **Add** (⊕) button and existing styles are deleted with the **Remove** button. The parameters of the highlighted style in the list are shown on the right side of the dialog.

The **Type** popup menu has two items: **Screen** and **World**. They specify how the values entered in the dialog will be interpreted. Screen values remain the same regardless of the scale of a drawing, while world values are affected by the zoom factor and are scaled accordingly.

The **Text** group of options specifies the details of the text appearance. **Size** and **Gutter** control how big it will be and how much space around it should be left blank. The **Font** menu offers a choice of fonts currently installed on the system. When **Include Units** is checked, unit measurement indications will also be displayed. The text currently specified is displayed in the **Text Sample** box.

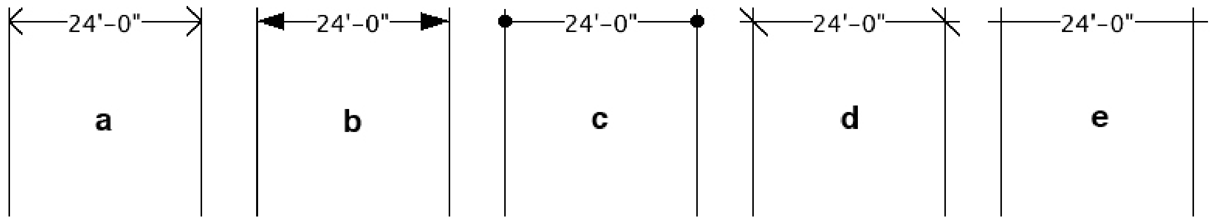
The two **Orientation** options determine whether the text is displayed in the plane of the dimension (**Aligned With Dimension**) or the text is drawn flat on the screen (**Horizontal On Screen**). See examples below.



Orientation of dimensions: (a) Aligned With Dimension (b) Horizontal On Screen.

There are three **Placement** options that determine if the text will be placed **Above**, **On** (default), or Under the dimension line. **Text Between Witness Lines** controls whether the text will always be placed between the witness lines, even when it needs extra scaling to fit.

The **Terminator** group specifies whether a terminator symbol will be placed at the **Start** and/or **End** of a dimension line. This can be one of a variety of available options or None. See examples below.

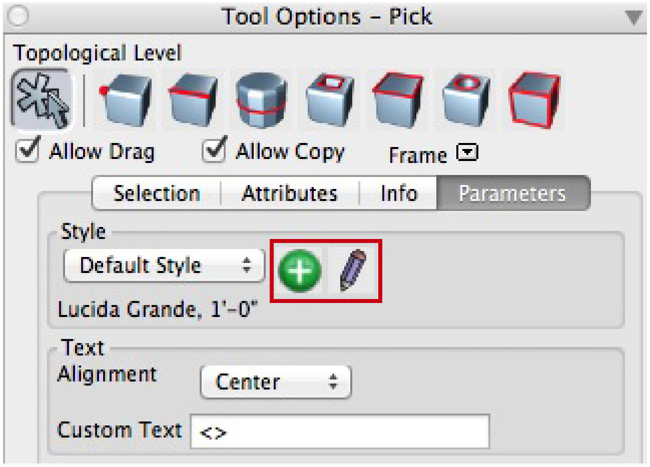


Terminator types: (a) Open Arrow, (b) Filled Arrow, (c) Dot, (d) Slash, and (e) None.

The **Witness Line** group controls whether there will be such lines at **Start** and/or **End** and contains options for their specification.

The measured quantities of a dimension are rounded by the values in the **Display Accuracy** fields. If no rounding is desired, zeroes should be entered, in which case the accuracy in the **Working** Units tab of the **Project Settings** dialog will be used.

The last two options determine if dimensions and text are dropped from the display, due to that they are viewed at a shallow angle or become very small because of zooming too far. If **Hide Dimensions By Screen Size** and **Hide Dimensions By View Angle** are checked, dimensions shorter than the indicated screen size or viewed at an angle less than the one specified are not displayed.



☑ Allow Drag
☑ Allow Copy

Default Style

Lucida Grande, 1'-0"

Alignment: Center

Custom Text: <>

The Tool Options palette with a Dimension selected.

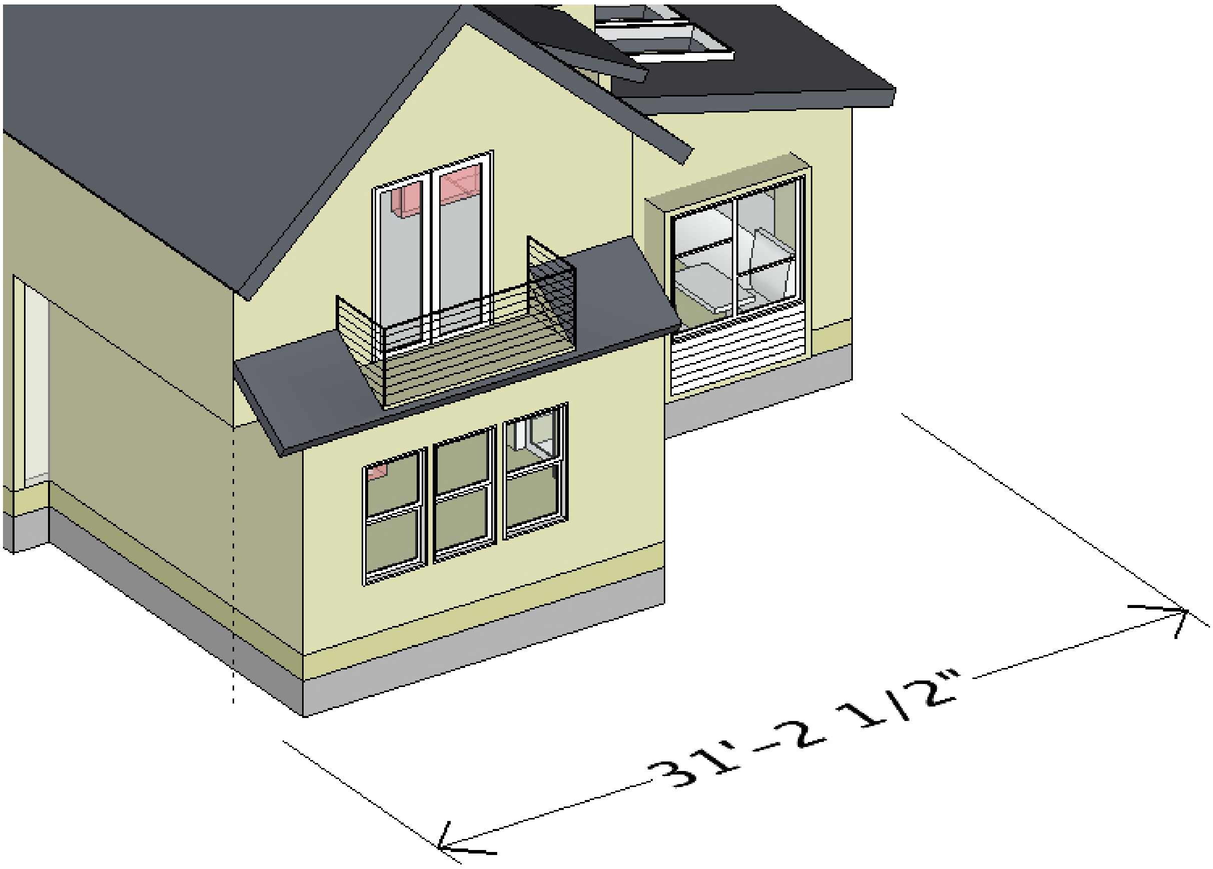
New in v. 7.1

⊕ and ✎ **Add Style** and **Edit Dimension** are buttons to quickly create new dimension styles or edit dimension style parameters.

Picking and editing dimensions

Dimensions, leader lines and text notes display graphics according to common drafting standards. Unlike other objects, they do not consist of the typical hierarchy of faces, outlines, segments and points. That is, they can only be picked as objects. However, they are controlled objects and their parameters can be edited in the **Tool Options** palette the same way as other objects.

The on screen controls allow you to modify the orientation and text offset of dimensions. Clicking in the arrow moves the dimension text in the plane of the dimension. Clicking on a point control moves that point to a new location. Note, that the dimension text updates interactively as the point is moved. The edited point can be snapped to existing object points, if object snapping is on. Note, that it is possible to snap the dimension point to a location that is not on the dimension plane. In this case, the point from which the dimension distance is calculated is first projected perpendicular on the plane. A dashed line from the snapped point to the dimension plane is drawn.



A linear dimension with a point snapped off the plane.

Associativity

If the points of a dimension were snapped to points of objects when they were created, or when a segment was selected, the dimension stays associated with the object points. If the object point is subsequently moved through a modeling operation, such as the **Reshape** tool, the dimension is automatically adjusted to follow the moved point. There are a number of modeling operations, which will not be able to maintain the associativity of a dimension with its referenced object. If this occurs, and the object is moved, the dimension will not follow along. However, this condition can easily be fixed with the following steps:

Select the dimension with the pick tool and turn on its controls (hit the f6 key or press the **Show Controls** button in the **Tool Options** palette).

Make sure that object snapping is enabled.

Select each dimension point control and move it back on the desired object point, using snapping. Sometimes this may mean snapping it back to the same point it already appeared on. The snapping will recreate the associativity.

Now, if the referenced object points are moved, the dimension will follow along.

Transferring Project Data

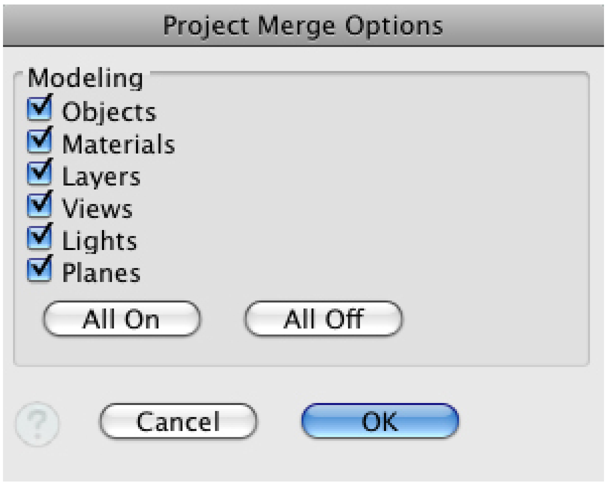
Data from one project can be transferred to another project. This can be done by adding (merging) the data from one project to another or by copying and pasting selected data between projects. In either case the desired data is explicitly chosen, however, there is also implicit data that must be transferred as well. For example, when transferring objects, an object’s layer and material must also be transferred. When there is a conflict between these items (for example, both projects have a material with the same name but a different appearance), a dialog is presented offering options for resolving the conflict.

- The **Add To Project** checkbox found in the **Open** dialog, can be used to transfer the contents of one project to another project. In such a case, the **Project Merge Options** dialog is invoked. This dialog allows for the selection of what type of data is transferred.

- The **Copy/Paste** items in the **Edit** menu can be used to copy objects, lights, and views from one project and paste them into another project.

When transferring data from one project to another, one of the following cases occurs:

1. The item transferred is unique. That is, the transferred item has a unique name and set of parameters. This being the most common case, the transferred item is simply added to the project.



☑ Objects
☑ Materials
☑ Layers
☑ Views
☑ Lights
☑ Planes

The Project Merge Options dialog.

2. The destination project already contains an item whose ***name and parameters*** are identical to those of the transferred item. In such a case, the program does not add the transferred item to the destination project.

3. The destination project contains an item whose ***parameters*** are the same as those of the transferred item, but the two items have different names. In such a case, the **Project Merge Conflicts** dialog is invoked.

4. The destination project contains an item whose ***name*** is the same as the name of the transferred item, but the parameters of the two items are different. In such a case, the **Project Merge Conflicts** dialog is invoked.

Project Merge Conflicts dialog

The **Project Merge Conflicts** dialog is invoked when items are transferred from one project to another and a conflict has occurred.

Each type of conflict (e.g. Materials) appears in its own tab. In each tab is a list of the items that have a conflict with a description of the conflict and the action that will take place when the OK button is clicked.

There are four columns in each list.

From “file name”: This column shows the name and an icon of the item that is in conflict with an existing item. If the names are in conflict the name will be drawn in red. In this case, the name can be double clicked to manually edit the name to a non-conflicting name. Clicking on the icon will select the item and draw a green border around the icon. When the item is selected, it will replace the existing item in the list. Clicking the icon again will deselect it, the green border will go away, and the default state of adding the conflicting item to the list will be set.

To “file name”: This column shows the name and an icon of the item that is in conflict with a new item. Clicking on the icon will select the item and draw a green border around the icon. When the item is selected, it will be used instead of the new item. Clicking the icon again will deselect it, the green border will go away, and the default state of adding the conflicting item to the list will be set.

Conflict: This column contains a description of the conflict.

The possible conflicts are:

- An item named “from item” exists in both “from file” and “to file” but have different parameters.
- “from item” from “from file” has the same parameters as “to item” from “to file.”

Action: This column contains a description of what action will be taken when the OK button is clicked.

The possible actions are:

- Add item “from item” to “to file.”
- Add item “from item” to “to file” and rename.
- Use item “from item” from “from file” instead of “to item” in “to file.”
- Use item “to item” from “to file” instead of “from item” in “from file.”

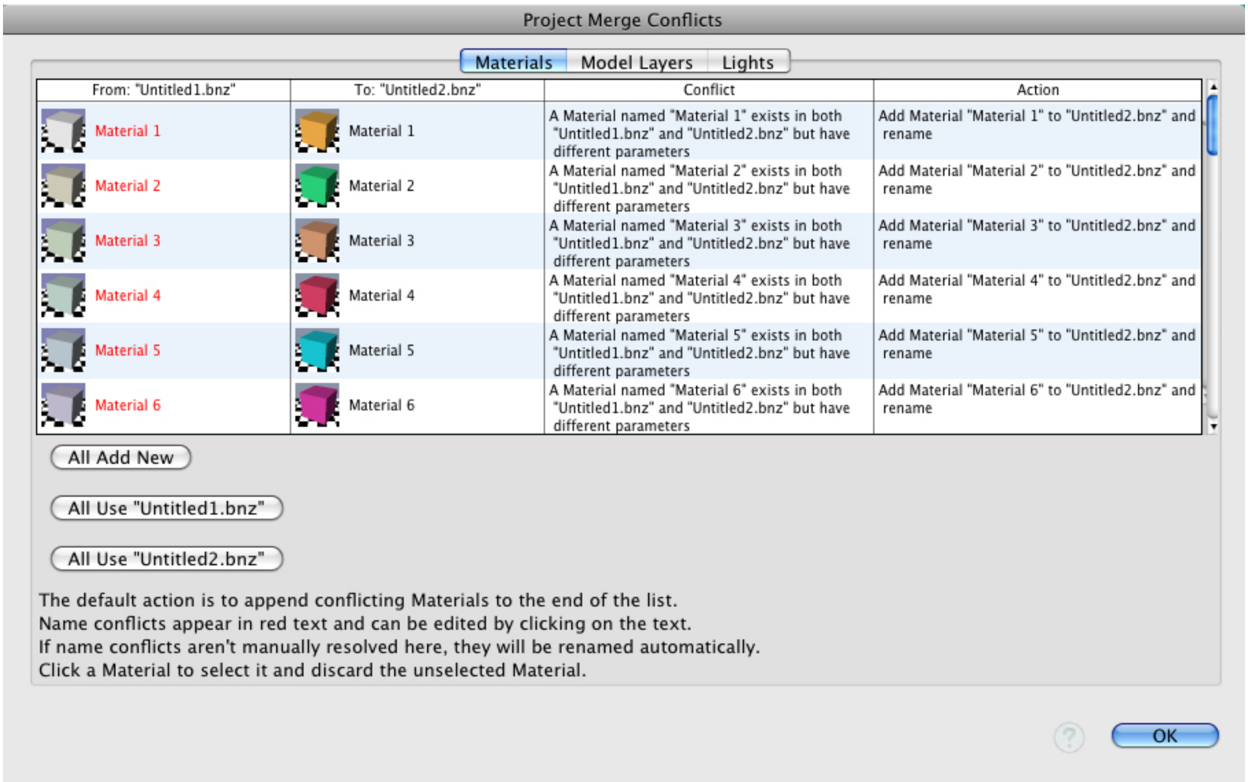
Below the list are three buttons:

Add All New: This is the default action for all conflicts. Clicking this button will set all conflicting items in the visible list to be added to the corresponding list. If the conflict is a name conflict, the **From** name in the list will be drawn in red. The name will be editable in this case by double-clicking the name. Any items with name conflicts that haven’t been resolved when the OK button is clicked will be automatically resolved by the program. If the transferred item is an attribute assigned to an entity also being copied into the project, the entity will reference the transferred palette item.

All Use “from file name”: Clicking this button will set all conflicting items in the visible list to use the item in the From “file name” column. If the item is an attribute, all the entities to which either the existing or the transferred item was assigned will reference the newly transferred item.

All Use “to file name”: Clicking this button will set all conflicting items in the visible list to use the item in the **To “file name”** column. If the transferred item is an attribute assigned to an entity also being copied into the project, the entity will reference the existing item with the same parameters as the transferred item.

Below the buttons are instructions on how this dialog works.



From: "Untitled1.bnz"	To: "Untitled2.bnz"	Conflict	Action
Material 1	Material 1	A Material named "Material 1" exists in both "Untitled1.bnz" and "Untitled2.bnz" but have different parameters	Add Material "Material 1" to "Untitled2.bnz" and rename
Material 2	Material 2	A Material named "Material 2" exists in both "Untitled1.bnz" and "Untitled2.bnz" but have different parameters	Add Material "Material 2" to "Untitled2.bnz" and rename
Material 3	Material 3	A Material named "Material 3" exists in both "Untitled1.bnz" and "Untitled2.bnz" but have different parameters	Add Material "Material 3" to "Untitled2.bnz" and rename
Material 4	Material 4	A Material named "Material 4" exists in both "Untitled1.bnz" and "Untitled2.bnz" but have different parameters	Add Material "Material 4" to "Untitled2.bnz" and rename
Material 5	Material 5	A Material named "Material 5" exists in both "Untitled1.bnz" and "Untitled2.bnz" but have different parameters	Add Material "Material 5" to "Untitled2.bnz" and rename
Material 6	Material 6	A Material named "Material 6" exists in both "Untitled1.bnz" and "Untitled2.bnz" but have different parameters	Add Material "Material 6" to "Untitled2.bnz" and rename

The default action is to append conflicting Materials to the end of the list.
Name conflicts appear in red text and can be edited by clicking on the text.
If name conflicts aren't manually resolved here, they will be renamed automatically.
Click a Material to select it and discard the unselected Material.

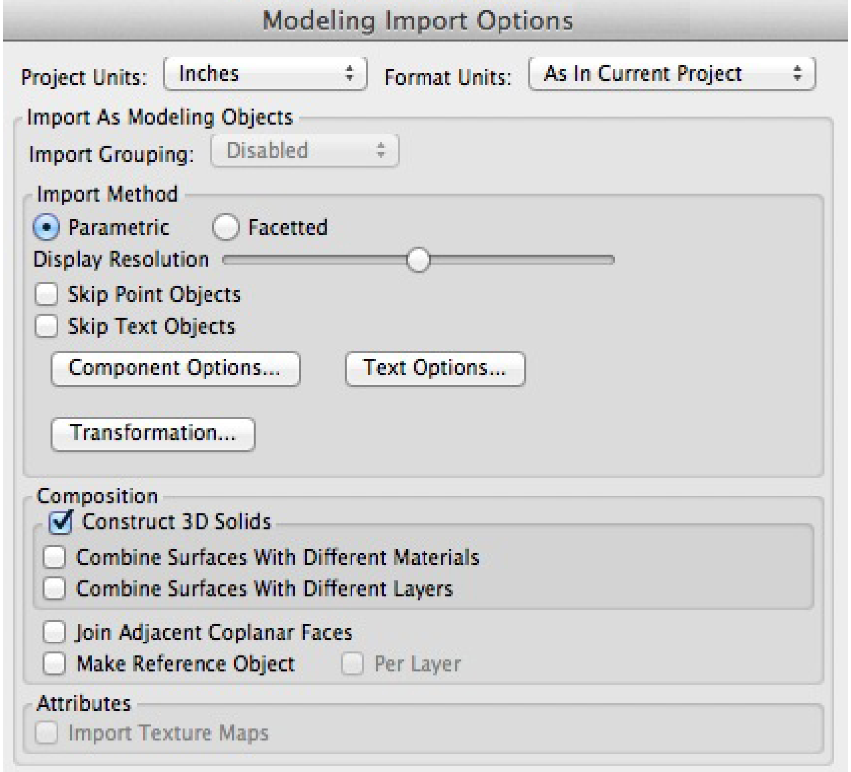
The Project Merge Conflicts dialog.

Importing and Exporting Object File Formats

In addition to its own project files, **form•Z** can import and export a variety of other formats. These are either object file formats,which transfer descriptions of 2D shapes and 3D objects, or image file formats that contain mostly bit mapped descriptions of scanned, captured, or rendered images. The object format files share a number of identical import and export options and therefore their dialogs share a common format. The common options are discussed first, then the options that are unique to each format.

Common object import options

The dialogs invoked when importing object files into **form•Z** share many common options. They consist of three sections. The top portion contains options for controlling the units. The next section is the common options for modeling (**Import As Modeling Objects**). The third section at the bottom of the dialog contains the options specific to the format (if any). Where an option does not apply to a certain format, it is dimmed.



Modeling Import Options

Project Units: Inches
Format Units: As In Current Project

Import As Modeling Objects

Import Grouping: Disabled

Import Method

● Parametric ○ Facetted

Display Resolution

☐ Skip Point Objects

☐ Skip Text Objects

Composition

☑ Construct 3D Solids

☐ Combine Surfaces With Different Materials

☐ Combine Surfaces With Different Layers

☐ Join Adjacent Coplanar Faces

☐ Make Reference Object ☐ Per Layer

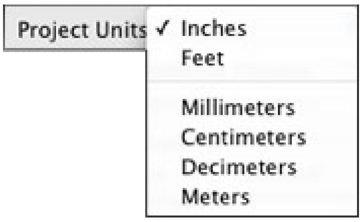
Attributes

☐ Import Texture Maps

The common import options.

Setting the units of the imported entities

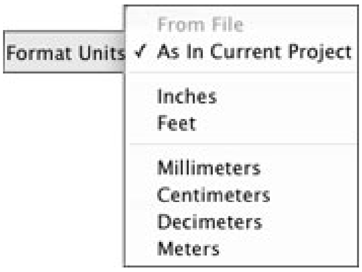
Most of the format files contain no information about the unit of measurement in which their numerics are written. For example, a 10 in DXF could be inches, feet, centimeters, meters, etc. For these formats it is necessary to tell **form•Z** what the units are, which is done through the following two pop up menus.



The Project Units Menu.

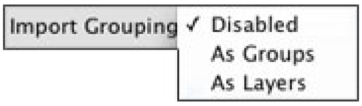
Project Units: This pop up menu determines how units will be set in **form•Z**, when the **Add To Project** option is not selected in the **Import** dialog. When on, this menu is dimmed and the units already set in the receiving project are used.

Format Units: The item selected from this pop up menu determines how the units in the imported file will be interpreted. **From File** is available only when the format of the imported file carries unit information and it reads the numbers as in the imported file. **As In Current Project** causes the units to be interpreted as determined by the selection in the **Project Units** pop up menu, or by the settings in the import project. All the other items specify the unit of measurement to be used.



The Format Units Menu.

Importing as modeling objects



The Import Grouping Menu.

Import Grouping: The items in this pop up menu set the hierarchy of the imported file. The first item is the default for all formats.

Disabled: When this item is on, no grouping information is constructed.

As Groups: For FACT files, when this option is on, their grouping hierarchy is converted into **form•Z** grouping with each child as a nested group to its parent object.

As Layers: For FACT files, when this option is on, the top level of each group in the file is represented as a **form•Z** layer, and all the children of the group are placed on the layer.

Import Method: This group of options controls the method used for converting imported objects to **form•Z** objects.

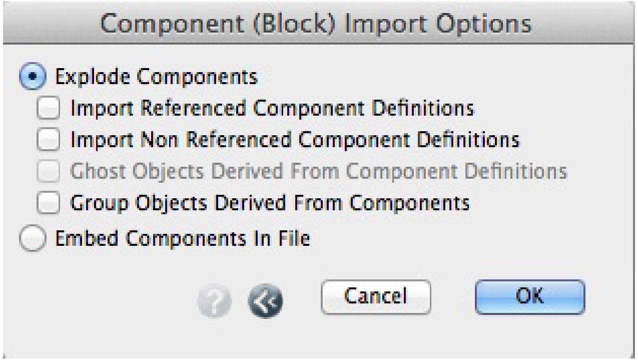
Parametric: To the extent possible, all parametric object data, NURBS data, smooth (ACIS) data will be preserved.

Facetted: All objects will be imported as plain facetted objects.

Display Resolution: This option sets the display resolution of imported smooth objects.

Skip Point Objects: Point objects are sometimes difficult to work around. Selecting this option will prevent point objects from being imported.

Skip Text Objects: Some files contain text used for annotation. It may not be desirable to import this text. Selecting this option prevents text objects from being imported.



Component (Block) Import Options

● Explode Components
☐ Import Referenced Component Definitions
☐ Import Non Referenced Component Definitions
☐ Ghost Objects Derived From Component Definitions
☐ Group Objects Derived From Components
○ Embed Components In File

The Component (Block) Import Options

Components: Files can contain components or blocks. These are separate files that may be referenced by the file that is being imported. They help save memory whenever a common element is placed multiple times in a file.

Explode Components: when importing files that contain components or blocks it is often useful to maintain these in some way. You can choose to discard this information, and there are several options available for handling these entites.

Import Referenced Component Definitions: this option will import components or blocks that are actually placed in the project, and ignore any that are a part of a library that have not been placed.

Import Non Referenced Component Definitions: this option will import all components or blocks that are associated with the project, including those in attached libraries.

Ghost Objects Derived From Component Definitions: this option will import the components or blocks that are associated with the project and ghost them.

Group Objects Derived From Components: this option will import the components or blocks that are associated with the project and group them.

Embed Components in File: this option will import all components or blocks that are associated with the project and place them into the **Embedded Component Library.**

Transformation: this button invokes an **Import/Export Transformation Dialog**, and contains simple controls for flipping coordinate system axes, inverting faces, ensuring **Normals Point Outward**, or simply scaling, rotating, or moving objects in import. This is used for esablishing import pipelines for 3rd party apps that may treat aome of these characteristics of the file differently.

Text Options currently has one option: **Replace Unavailable Fonts With**: This is a menu that lists the fonts available on the system **form•Z** is running on. If a file to be imported references a font that is not available, the font selected from this menu will be used as a substitute.

Constructing solids from closed polylines

Composition: Three dimensional entities imported from other applications are typically collections of polylines which, when taken together, enclose an entity equivalent of a solid. There is typically no information about which polylines belong together. The options in this group tell **form•Z** how to import these entities into its modeling environment in a meaningful manner.

Construct 3D Solids: When this option is on, groups of surfaces whose edges touch are compiled and solid objects are constructed from them, provided these sets of surfaces are complete and satisfy the closure requirement. That is, for **form•Z** to be fully successful in this task, the imported data should contain all the surfaces that are needed to completely enclose a solid object. **form•Z** does not attempt to create faces that may be missing. It will create as many solid objects as possible. Surfaces that fail to incorporate in the representation of a solid are imported as surface objects.

Combine Surfaces With Different Materials: When this option is selected, surfaces with differing materials will be combined to make solids. If this option is not selected, only surfaces with the same material will be combined.

Combine Surfaces With Different Layers: With this option selected, surfaces on differing layers will be combined to make solids. If this option is not selected, only surfaces on the same layer will be combined.

Join Adjacent Coplanar Faces: When this option is selected, the system will automatically join all adjacent (sharing an edge) and coplanar faces of the same object into single faces. This option is independent of the **Construct 3D Solids** option.

Make Reference Object: When this option is selected, all imported objects will be joined into one reference object. This is useful when the imported file contains many small separate line objects. **form•Z's** objects are fairly memory intensive, so combining all the imported geometry into one object saves system memory. All parts of a reference object are snapable so the object can be used for tracing to reconstruct the geometry in a more useful form.

When **Per Layer** is also on, a separate reference object will be created for each layer.

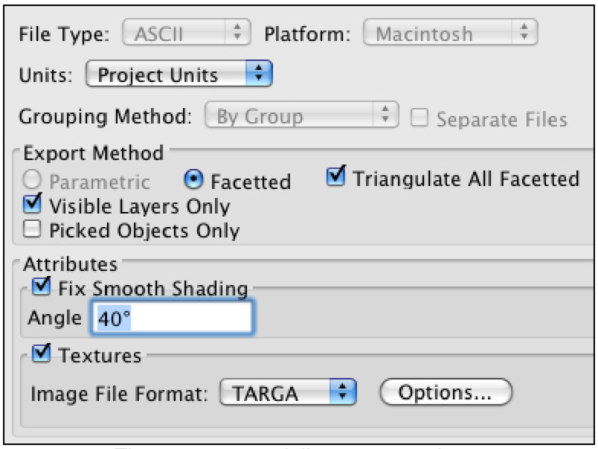
Importing materials and textures

When importing entities through a file format that handles colors, these colors also need to be imported or approximated as closely as possible. Most use an RGB representation for colors, which is consistent with what **form•Z** uses.

Import Textures: If this option is selected, textures will be imported.

Common object export options

As with importing, the dialogs invoked when exporting modeling object files share many common options, which are displayed at the upper portions of the dialogs. The lower sections contain format specific options. Where one of the common options does not apply to a format, it is dimmed in the respective dialog.

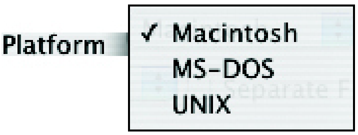

File Type: ASCII
Platform: Macintosh
Units: Project Units
Grouping Method: By Group
☐ Separate Files
Export Method
○ Parametric
● Facetted
☑ Triangulate All Facetted
☑ Visible Layers Only
☐ Picked Objects Only
Attributes
☑ Fix Smooth Shading
Angle 40°
☑ Textures
Image File Format: TARGA

The common modeling export options.

Notation and platform types

When exporting to formats that support both ASCII and binary notations (SAT and STL) options to select one or the other are available.

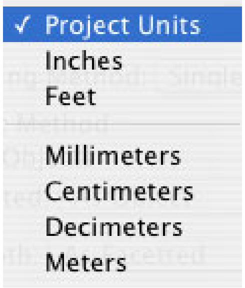
File Type: This pop up menu contains two items: **ASCII** and **Binary**. Either one can be selected. All the export file formats that can be saved as ASCII text, except SAT, support the **Platform** pop up menu. Most file formats that are exclusively ASCII always have the Platform menu available. For file formats that can be either ASCII or binary the **Platform** menu is available when **ASCII** is selected and dimmed when **Binary** is selected from the **File Type** menu. The default selection of **Platform** is initially set according to the platform **form•Z** is currently running.



The Platform Menu.

Export units

The following option applies when a format does not contain its own unit specification method.



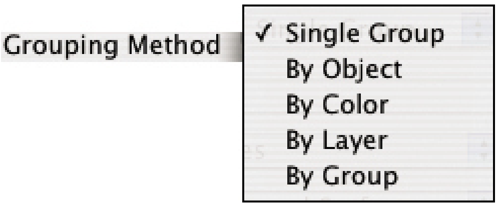
Units Menu.

Units: This pop up menu sets the linear units of the exported data. When the **Project Units** item is selected, the data is exported in the units set in the **Working Units** tab of the **Project Settings** dialog. When one of the other items is selected, the respective unit is used to export the data.

Note again that the options in this menu only apply to formats that do not have their own unit specification options. The ones that do, such as Lightwave, use their own specifications. For these formats this pop up menu is dimmed and unavailable.

Grouping method

When exporting a **form•Z** project, the objects it contains may be structured as a single group or as many groups. These groups can be structured to contain one object each, all the objects of the same color, all the objects on the same layer, or all the objects that belong to the same **form•Z** group. When exporting to DWG, DXF, FACT, and OBJ, which provide grouping structures, these groups can be exported in a single file, or one file can be constructed per group. When more than one file is exported from a single **form•Z** project, they are placed in a folder.



Grouping Method pull down menu.

Grouping Method: This pull down menu contains five grouping methods.

> **Single Group**: With this method (default), all objects become a single group and one file is exported.
>
> **By Object**: With this option, each object becomes a separate group. When **Separate Files** is also on, then each object is placed into a separate file.
>
> **By Material**: When this method is selected, all **form•Z** objects or faces of the same material form a separate group. For file formats that do not carry color or material, this method allows you to reassign uniform colors or materials to groups of objects after they have been imported into other programs.
>
> **By Layer**: When this grouping method is selected, all **form•Z** objects that are on the same layer are grouped together, which allows you to preserve the layers set up in the **form•Z** file.
>
> **By Group**: Selection of this method preserves the **form•Z** groups and transforms them into the grouping structure of the destination program, if one exists, or exports them as separate files.

Separate Files: When this option is selected, a separate file is constructed for each of the groups defined by the selection from the **Grouping Method** menu. These separate files are all saved into a newly created folder, which takes its name from the name entered into the name field of the **Save** dialog. The names of the individual files are constructed from the grouping method and an extension that specifies the type of file. For the first part of the name, if the grouping method is **By Object**, the object name is used; if **By Material**, the material name; if **By Layer**, the layer name; and if **By Group**, the group name is used. This option is dimmed and inactive when **Single Group** is selected.

Export method

This group of options specifies how **form•Z** objects will be exported.

Parametric: When this option is on, parametric objects and smooth (**ACIS**) objects will be exported to the extent supported by the file format.

Facetted: When this option is selected, all objects will be exported as plain facetted objects.

> **Triangulate All Facetted**: When this option is selected, all objects will be triangulated.

Visible Layers Only: All the export formats allow you to export only parts of a project by organizing it into layers that may or may not be visible. When this option is on, only the objects on visible layers are exported.

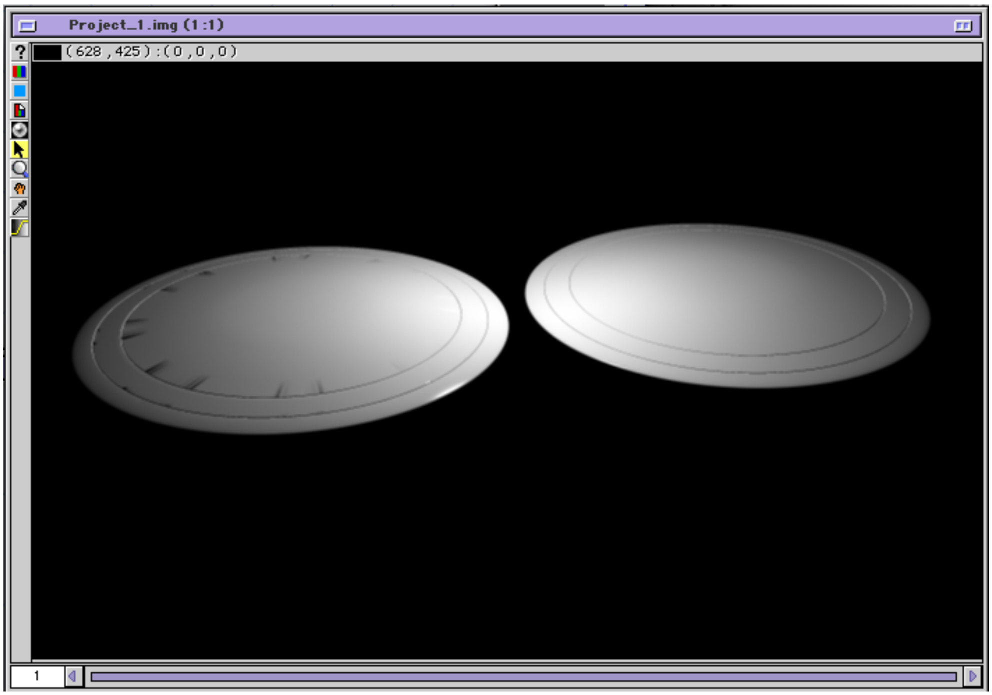
Picked Objects Only: When this option is on, only the objects that appear selected on the screen will be exported.

Exporting materials and textures

In **form•Z**, different colors may be assigned at the object and face levels, as well as rendering parameters relating to the smooth shading of surfaces. Material parameters and texture maps may also be assigned. The ability to export these parameters is available for many of the export formats using the following options.

Attributes: This section contains options that specify how colors, normals, shading, and textures are exported, as follows:

> **Fix Smooth Shading**: Rendering applications apply smooth shading across surfaces that share common edges. When smooth shading between two neighboring surfaces is not desired, these surfaces should be disconnected and represented as independent surfaces. To achieve these effects, a **form•Z** model can be decomposed into parts using modeling tools available in the program. This option can also be used to determine which faces will be exported as continuous surfaces (and are thus smoothly shaded), and which faces will be exported as independent surfaces. The distinction is made on the basis of the angle at the common edge of two surfaces, which is entered in the **Angle** field, typically found next to this option in the export dialogs. When this option is selected, only the faces whose angle is less than that shown are exported as continuous surfaces and are smooth shaded by the rendering application. Neighboring faces with larger angles are exported as discontinuous surfaces.
>
> **High Quality Smoothing**: When this option is selected, the exported file will contain more accurate smoothing normals. This is intended for situations where the exported data is to be used for rendering and the quality of the smoothing normals is more important than the cleaning of small features in the object's mesh. This option should NOT be used for 3D printing applications or any situation where a water-tight model is important.



High Quality Smoothing: Off (left), High Quality Smoothing: On (right). Rendered in Electric Image.

Textures: If this option is selected, textures will be exported.

Image File Format: This menu lists the texture image files supported by the file format. Use this menu to select the texture image format.

Options...: This button brings up the image export options dialog for the selected texture image format. For a description of this dialog, see the **Common Image Export Options** section later in this manual.

Tips and warnings

The following are some recommendations that will produce the best results, when exporting/importing texture map parameters:

When importing a file without importing its textures, only the file you select is imported. When you import with the **Import Texture Maps** option on, in addition to the main file, a number of other support files, mostly image maps, also need to be imported. Texture map importing relies heavily on the validity of these support resources. Make sure that all the support files (image maps and material files) required by the main file are present; that they are compatible with the main file; that they are of an image type recognized by **form•Z**, if they are images; and that they have correct file names. If one or more of the above mentioned conditions are not satisfied, error messages are issued and importing may terminate. Needless to say that when you have an incomplete set of support files, the main file can still be imported by turning off the **Import Texture Maps** option.

When exporting spherical or cylindrical texture maps applied to relative large surfaces, which are converted to UV coordinates, the exported models may not render accurately in other applications. You may improve the rendering quality these applications can produce from such maps by increasing the resolution of the **form•Z** models, using one of the **Mesh** tools. When special cases are encountered as you import/export files with texture maps, you are warned at the end of the operation. These cases include file name changes due to file format syntax restrictions, image map conversions, failure to locate image maps, or exporting files with unsupported image formats.

3DS

3DS is a file format used by Autodesk's 3D Studio® to store modeling and animation information. A 3DS file can have an **object** section and a **keyframe** section, which transfers animation parameters. **form•Z** reads and writes only the object section of a 3DS file and does not support its animation portion. 3DS is a binary encoded format.

Importing 3DS files

A 3DS file is imported into **form•Z** in the standard manner and all the options in the **Modeling Import Options: 3DS** dialog are general type of options. The 3DS lights, cameras, and materials are converted as closely as possible to **form•Z** lights, views, and materials.

Exporting 3DS files

A **form•Z** project is exported as a 3DS file in the standard manner and only modeling objects can be exported to 3DS files. All the options in the **Modeling Export Options: 3DS** dialog are common options.
All the **form•Z** modeling objects are triangulated when they are exported to 3DS. Also, all the control objects lose their controls, since they are not supported by 3DS. The **form•Z** lights, views, and surface styles are converted to the closest 3DS lights, cameras, and materials.

How are textures handled

The 3DS file format supports plain color, image maps, ambient, diffuse, and specular reflections, roughness, specular color, and transmission. It also supports transparency maps and bump maps.

When importing a 3DS file, and the file contains references to texture maps, all the image types recognized by **form•Z** are considered valid texture maps.

The **form•Z** texture map controls are converted to UV coordinates (or rendering coordinates in 3DS terms) at export and are imported as UV coordinates from the 3DS files.

Collada

The Collada file format takes its name from **Colla**borative **D**esign **A**ctivity and its extension is ".dae" that stands for **d**igital **a**sset **e**xchange. This format may be used to transfer object geometry, textures, and other 3D data.

Collada can be used for both importing and exporting.

To import invoke the **Modeling Import Options: Collada** dialog, which is a standard import dialog. That is, it only contains general type of options and has no Collada specific options. In this dialog, the **Import Textures** option is on by default.

To export invoke the **Modeling Export Options: Collada** dialog, which is again a standard export dialog. That is, it only contains general type of options and has no Collada specific options.

DXF

DXF (Drawing Interchange Format) is the format in which **AutoCAD®** saves and exports its drawings. **AutoCAD®** was initially an exclusively 2D drafting system. It was later extended to include 3D capabilities. However, its internal data structures and its output format retained, to a large extent, the characteristics of the original drafting oriented representations. The **AutoCAD®** entities which appear as 3D objects when displayed, are in fact groups of separate surfaces. Furthermore, they are surfaces of at most four sides and they cannot contain holes.

DXF files may also contain **block definitions** and **insertions**. The blocks (called symbols by other programs) represent the ability to define entities which can then be placed as copies or instances, called insertions. An insertion is not a complete representation of the entity, but rather points to the definition of that entity in some central library of representations, called block definitions. A DXF file may contain block definitions that have been placed (inserted) one or more times, as well as definitions that have not been placed. A placed block definition is called a **referenced block**. Otherwise, it is called a non-referenced block. **form•Z** only imports referenced blocks. Each block becomes a copy of that block transformed to the correct location, scale and orientation.

When exporting facetted data, faces that consist of at most four sides and contain no holes, can be exported directly as they are. However, faces with more than four points or faces with holes have to be decomposed to the type of surfaces that DXF can handle.

Importing DXF files

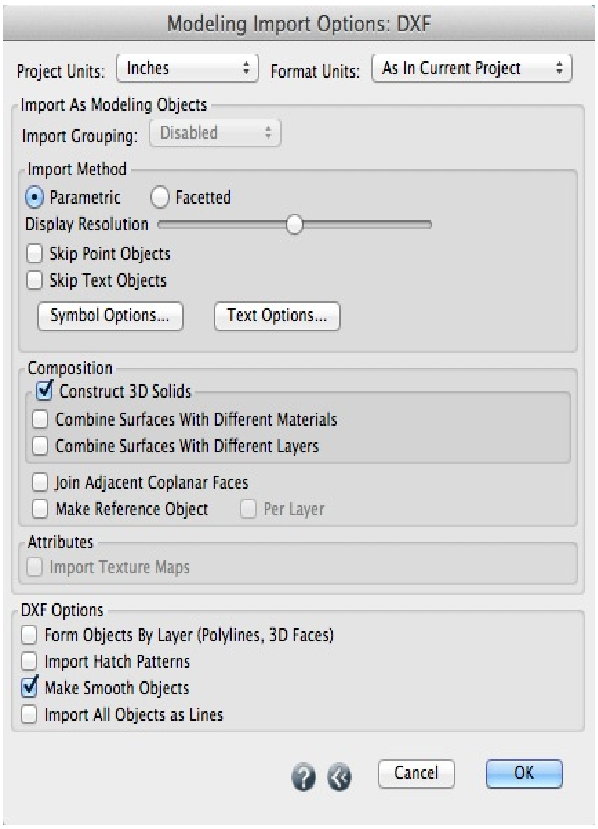
A DXF file is imported into **form•Z** in the standard manner. In addition to the common options, the **Modeling Import Options: DXF** dialog contains a number of format specific options:

Form Object By Layer (Polylines, 3D Faces): When this option is on, simple objects are constructed from all the polylines and 3D faces on a layer. This option is not available when **Make Reference Object** is selected.

Import Hatch Patterns: When this option is selected, hatch entities are read as individual lines. This can result in a large number of line objects being generated. If this option is not selected, hatch patterns are not imported.

Make Smooth Objects: When this option is selected, objects which can be represented as smooth objects (e.g. splines, arcs, circles, etc.) will be imported as smooth objects. Selecting this option for a large file can greatly increase the import time. If this option is not selected, all entities except REGION, SOLID3D, and BODY will be imported as facetted.

Import All Objects As Lines: When 2D line data is imported from a DXF file, closed lines are imported as surfaces. This is often undesirable because the fill on the surfaces can obscure other line objects. When this option is selected, the **Render As Wire frame** attribute is set for all imported objects.



Modeling Import Options: DXF

Project Units: Inches
Format Units: As In Current Project

Import As Modeling Objects
Import Grouping: Disabled

Import Method
● Parametric ○ Facetted
Display Resolution
☐ Skip Point Objects
☐ Skip Text Objects

Composition
☑ Construct 3D Solids
☐ Combine Surfaces With Different Materials
☐ Combine Surfaces With Different Layers
☐ Join Adjacent Coplanar Faces
☐ Make Reference Object ☐ Per Layer

Attributes
☐ Import Texture Maps

DXF Options
☐ Form Objects By Layer (Polylines, 3D Faces)
☐ Import Hatch Patterns
☑ Make Smooth Objects
☐ Import All Objects as Lines

The Modeling Import Options: DXF dialog.

Exporting DXF files

The content of a **form•Z** project is exported as a DXF file in the standard manner. In addition to the common export options, there are also a number of DXF specific options.

Export Facetted Objects As ACIS Objects: When this option is selected, facetted objects are written to the DXF file as embedded ACIS entities rather than native DXF entities. Note that not all software that can read DXF files supports the ability to read the embedded ACIS entities. This option is off by default.

Version: This pop up menu, allows you to indicate which version of AutoCAD the DXF file will be exported to. The default is **2007/2008**.

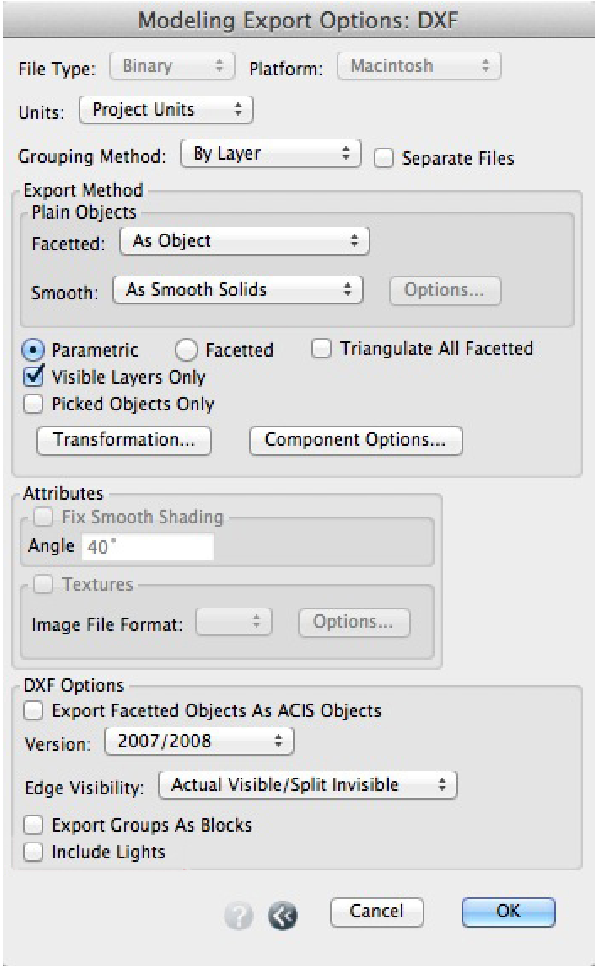
Edge Visibility: This pull down menu contains three options that control the visibility of the edges of the exported 3D faces.

All Visible: Selecting this option causes all the edges, both the original edges and the edges resulting from the splitting, to be marked as visible.

All Invisible: Selecting this option causes all the edges, both the original edges and the edges resulting from the splitting, to be marked as invisible.

Actual Visible/Split Invisible: This is the default option and causes the split edges to be invisible, while the original edges of the faces remain visible.

Export Groups As Blocks: When this option is selected, **form•Z** groups will be exported as blocks. The groups are defined by the **Grouping Method** in the common options (e.g. if the **Grouping Method** is set to **By Color**, objects of the same color will be considered a group and will be exported as a block). To export groups, defined in the object palette as blocks, set the **Grouping Method** to **By Group**.



Modeling Export Options: DXF

File Type: Binary   Platform: Macintosh

Units: Project Units

Grouping Method: By Layer   ☐ Separate Files

Export Method

Plain Objects

Facetted: As Object

Smooth: As Smooth Solids

● Parametric   ○ Facetted   ☐ Triangulate All Facetted

☑ Visible Layers Only

☐ Picked Objects Only

Attributes

☐ Fix Smooth Shading

Angle 40˚

☐ Textures

Image File Format:

DXF Options

☐ Export Facetted Objects As ACIS Objects

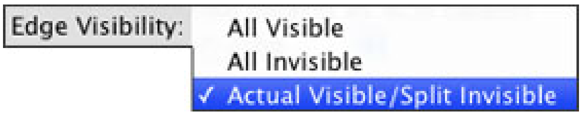
Version: 2007/2008

Edge Visibility: Actual Visible/Split Invisible

☐ Export Groups As Blocks

☐ Include Lights

The Modeling Export Options: DXF dialog.



Edge Visibility:

All Visible

All Invisible

✓ Actual Visible/Split Invisible

The Edge Visibility menu.

Include Lights: when this option is selected, the lights in the project will be included in the exported file.

DWG

DWG is the native format of **AutoCAD®**. While it is more efficient than DXF, the other **AutoCAD®** format, the structure of its entities is quite similar to DXF's. Consequently, the interface of the DWG translator is very similar to DXF's and the following discussion makes frequent references to the ways DXF works.

Supported entity types

When **form•Z** exports to DWG, a variety of versions can be selected. When importing, the version information is automatically extracted and placed in a **form•Z** project file. The following table summarizes the **AutoCAD®** entity types supported by the **form•Z** DWG format translator:

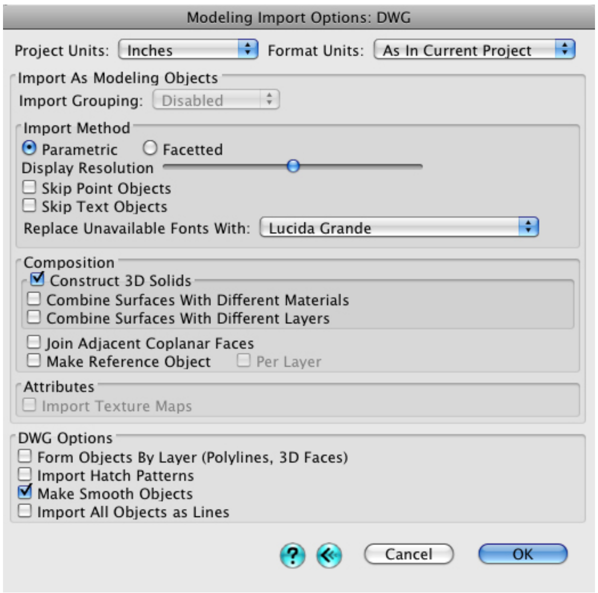
Entity types:	**Importing**	**Exporting**
TEXT	√	*
MTEXT	√	√
INSERT	√	√
MINSERT	√	
POLYLINES	√	√
3DFACE	√	√
LINE	√	√
MLINE	√	
CIRCLE	√	√
ARCS	√	√
ELLIPSE	√	√
DIMENSION	√	√
LEADER	√	√
SOLID	√	
TRACE	√	
SPLINE	√	√
POINT	√	√
PROXY	√	
HATCH	√	√
ACIS:		
REGION	√	
SOLID3D	√	√
BODY	√	
Tables:		
LAYER	√	√
BLOCK	√	√
LINE TYPE	√	√
LIGHTS	√	√

VIEWS	√	√
VIEWPORTS		

* Text entities are exported only when exporting to version 12.
Otherwise text entities are not exported.

Importing DWG files

The import options are set in the **Modeling Import Options: DWG dialog**, which in addition to the common options contain format specific options. These are identical to those used when importing DXF files.



Modeling Import Options: DWG

Project Units: Inches
Format Units: As In Current Project

Import As Modeling Objects
Import Grouping: Disabled

Import Method
● Parametric ○ Facetted
Display Resolution
☐ Skip Point Objects
☐ Skip Text Objects
Replace Unavailable Fonts With: Lucida Grande

Composition
☑ Construct 3D Solids
☐ Combine Surfaces With Different Materials
☐ Combine Surfaces With Different Layers
☐ Join Adjacent Coplanar Faces
☐ Make Reference Object ☐ Per Layer

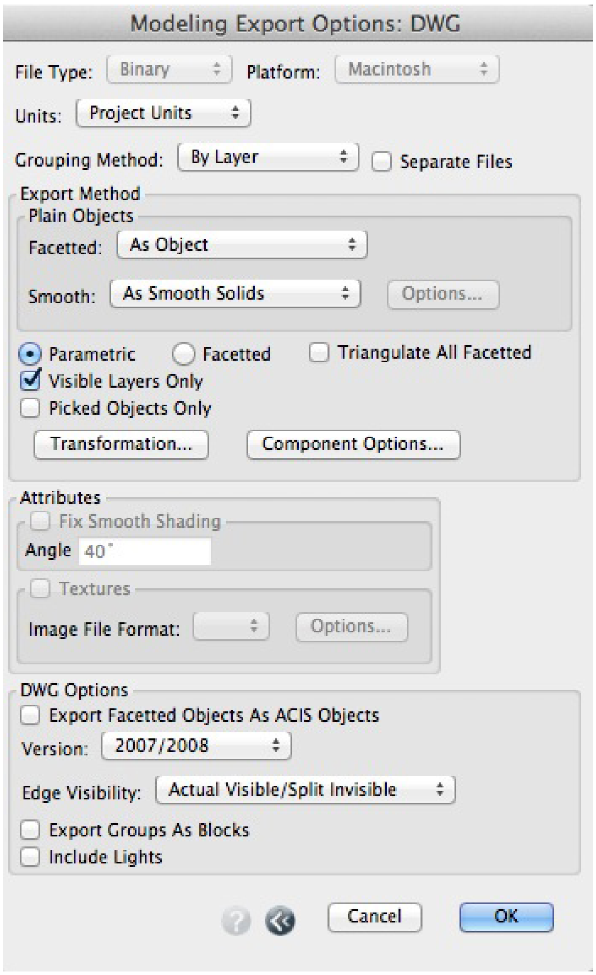
Attributes
☐ Import Texture Maps

DWG Options
☐ Form Objects By Layer (Polylines, 3D Faces)
☐ Import Hatch Patterns
☑ Make Smooth Objects
☐ Import All Objects as Lines

The Modeling Import Options: DWG dialog.

Exporting DWG files

The format specific options found in the **Modeling Export Options: DWG** dialog are again as for exporting DXF files.



Modeling Export Options: DWG

File Type: Binary
Platform: Macintosh
Units: Project Units
Grouping Method: By Layer ☐ Separate Files

Export Method
Plain Objects
Facetted: As Object
Smooth: As Smooth Solids
● Parametric ○ Facetted ☐ Triangulate All Facetted
☑ Visible Layers Only
☐ Picked Objects Only

Attributes
☐ Fix Smooth Shading
Angle 40˚
☐ Textures
Image File Format:

DWG Options
☐ Export Facetted Objects As ACIS Objects
Version: 2007/2008
Edge Visibility: Actual Visible/Split Invisible
☐ Export Groups As Blocks
☐ Include Lights

The Modeling Export Options: DWG dialog.

Google Earth

This file format, which is similar to Collada, can be used for transferring Google Earth models.
The Google Earth files have the extension ".kmz" and can be used for both importing and exporting.

To import invoke the **Modeling Import Options: Google Earth** dialog, which is a standard import dialog. That is, it only contains general type of options and has no Google Earth specific options. In this dialog, the **Import Textures** option is on by default.

To export, invoke the **Modeling Export Options: Google Earth** dialog, which is a standard export dialog with two additional Google Earth specific options:

Latitude and Longitude: The values entered in these fields represent the location in Google Earth where the exported model will be placed.

OBJ

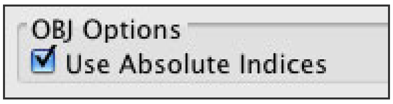
OBJ is a data file format originally used by Wavefront, which has been withdrawn from circulation. It contains representations of the geometry and other properties of objects. It supports polygonal objects, controlled curves, and controlled meshes. OBJ files are always ASCII files.

Importing OBJ files

An OBJ file is imported into **form•Z** in the standard manner. The **Modeling Import Options: OBJ** dialog contains one format specific option, **Use Absolute Indices**. The same option is also found in the **Export** dialog and is discussed below.

Exporting OBJ files

The content of a **form•Z** project is exported as an OBJ file in the standard manner. The **Modeling Export Options: OBJ** dialog contains all common options and one format specific option.



OBJ Options

☑ Use Absolute Indices

The OBJ specific export options.

Use Absolute Indices: The OBJ format offers the option to export with either absolute or relative indices. When this option is off, which is the default, data will be exported with relative indices. If on, absolute indices will be exported. Note that some programs that import OBJ files only read absolute indices. Data intended for such programs should be exported with this option on.

How textures are handled

The OBJ format supports plain color, image maps, ambient, diffuse, and specular reflections, roughness, specular color, transmission, refraction, transparency maps, and bump maps.

When importing a MTL file associated with an OBJ file, and the material file contains references to texture maps, all the image types recognized by **form•Z** under the active platform are considered valid texture maps.

The **form•Z** texture map controls are converted to U,V coordinates at export and are imported as U,V coordinates from the OBJ files.

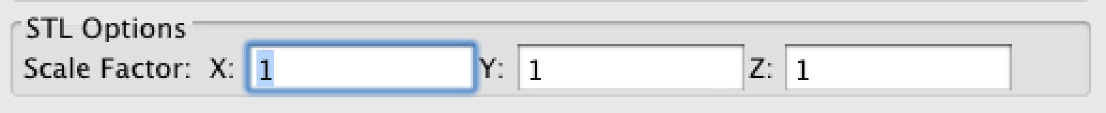
STL

STL is a file format that is used by rapid prototyping machines for producing 3D physical models from computer models. The rapid prototyping process typically consists of two stages. A preprocessing computer is first used that reads the STL file, reconstructs the 3D model, and slices it into horizontal cross sections, at a thickness of approximately 1/1000". Then a manufacturing device is used to physically build each cross section. These physical "slices" are placed on top of each other in the order they are derived and then glued, resulting in a layered 3D model.

The rapid prototyping process imposes a series of restrictions on the 3D model to be manufactured. The model must be described by one or more closed volumes. Independent surfaces and overlapping volumes are not allowed. STL accepts triangular faces only; consequently, **form•Z** decomposes all the faces of an object into triangular faces before the object is exported. Each triangular face cannot exceed a given minimum size. The maximum size of the model is also limited by the manufacturing apparatus. Sometimes, support structures also need to be added to the model in order to prevent structurally weak parts from bending during the construction process. Once the model is finished, the support structures are usually removed.

Importing STL files

An STL file is imported into **form•Z** in the standard manner. The **Modeling Import Options: STL** dialog contains one set of format specific parameters.



STL Options

Scale Factor: X: 1 Y: 1 Z: 1

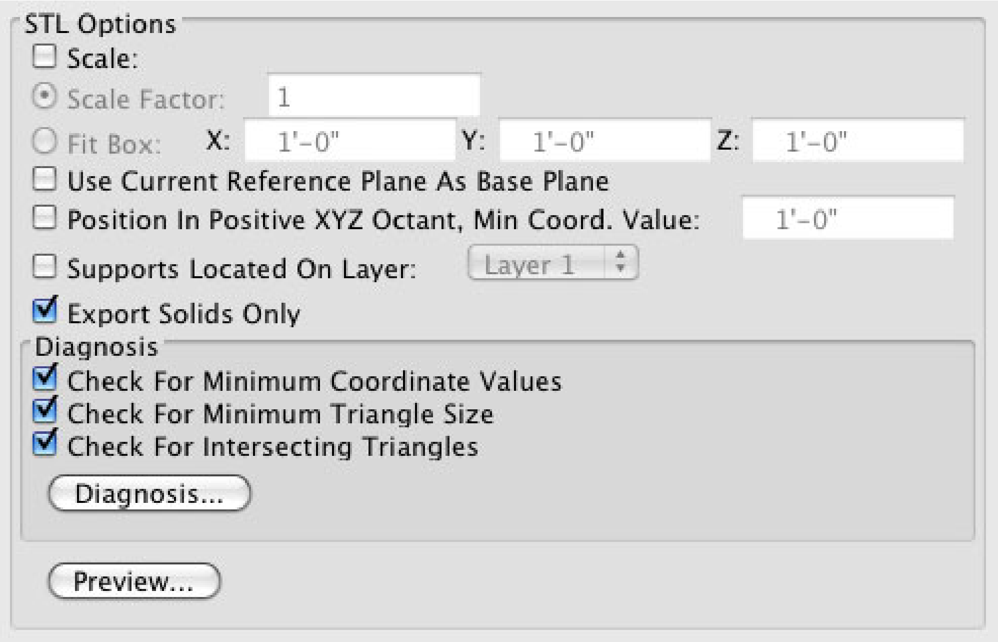
The STL specific import options.

Scale Factor: X, Y, Z: The scale factors entered in these fields are applied to the geometry of the imported model. If no scaling is needed, these values should be kept to 1.0, which are the default values.

Exporting STL files

The content of a **form•Z** project is exported as an STL file in the standard manner. The desired options are set in the **Modeling Export Options: STL** dialog, which contains a number of format specific options.

Scale: Typically, rapid prototyping machines are limited to building models of a certain size, which may make it necessary to scale the computer model when it is exported. This can be done by selecting the Scale option and entering the appropriate scaling parameters.



STL Options

☐ Scale:

● Scale Factor: 1

○ Fit Box: X: 1'-0" Y: 1'-0" Z: 1'-0"

☐ Use Current Reference Plane As Base Plane

☐ Position In Positive XYZ Octant, Min Coord. Value: 1'-0"

☐ Supports Located On Layer: Layer 1

☑ Export Solids Only

Diagnosis

☑ Check For Minimum Coordinate Values

☑ Check For Minimum Triangle Size

☑ Check For Intersecting Triangles

The STL specific import options.

Scale Factor: When this option is selected, the scale factor contained in its field will be uniformly applied in all directions to the model.

Fit Box: When this option is selected, the model is scaled to fit in a bounding box whose size is determined by the numeric values contained in the **X**, **Y**, and **Z** fields.

Use Current Reference Plane As Base Plane: Typically, the direction in which STL models are sliced is determined by the actual coordinates of the model. That is, the slices are parallel to the XY plane. This option allows you to manipulate the direction of the slicing. When selected, the model will be exported with its coordinates defined relative to the reference plane (the reference plane becomes the XY plane). This will result in slices parallel to the reference plane.

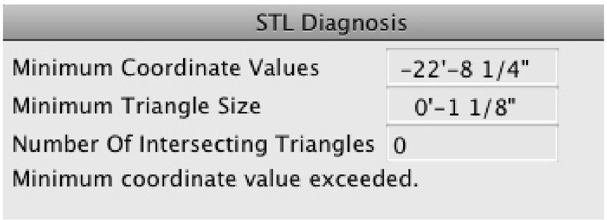
Position In Positive XYZ Octant: When this option is selected, the position of the model is automatically adjusted so that all its coordinates take positive values and no coordinate value is less than that specified in the **Min. Coord. Value** field. Some rapid prototyping systems require the model data to be located entirely in the positive XYZ octant. That is, they do not accept negative and zero coordinates.

Supports Located On Layer: Selection of this option informs **form•Z** that a support structure will be created and its description (model) is in the layer whose name appears in the field next to the option. All the objects found in the indicated layer are interpreted as support structures and are saved into a separate STL file, which is labeled by adding "sup" to the name used for the model file (for example: mod1.stl becomes mod1sup.stl). If the rapid prototyping process requires support structures, they need to be saved in a separate STL file, which is done automatically by **form•Z**. Note that the model itself should neither be nor have any parts on the layer where the support structures are. If it does, the result will be different from what was intended.

Export Solids Only: When this option is on, only solid objects are exported to the STL file. This option is on by default. When this option is off, solids, surfaces, and closed wire objects are exported.

Note that a properly formatted STL file should describe a solid object. This can be guaranteed by turning this option on. However, some rapid prototyping and 3D printing systems can, to a certain degree, deal with surfaces and have the ability to fix gaps or stitch surfaces together to produce solids. If this is not the case, the **Export Solids Only** option should be turned on.

Diagnosis: This group of options may be used to instruct the system to check your data before actually producing an STL file. The diagnostic process is applied as soon as you click on the **Diagnosis...** button. What is checked is determined by the currently selected options, all of which are on by default. The diagnostic results are posted in the **STL Diagnosis** dialog. In addition to counts of entities that were found in violation of certain STL requirements, this dialog posts error messages in a boxed area, when irregularities are detected in the data.



Minimum Coordinate Values -22'-8 1/4"

Minimum Triangle Size 0'-1 1/8"

Number Of Intersecting Triangles 0

Minimum coordinate value exceeded.

The STL Diagnosis dialog.

Minimum Coordinate Values: With this is on, all coordinates are checked against the value in the **Minimum Coordinate Values** field. If lesser values are found, the smallest is posted in this field.

Minimum Triangle Size: When this option is selected, the lengths of the sides of all the triangles that resulted from the triangulation of the object are calculated. If sides smaller than 1/1000" are found, an error is issued and the smallest side length is posted in the numeric field. These triangle size restrictions are dictated by the current state of technology of the rapid prototyping machines.

Number Of Intersecting Triangles: When this option is selected, all triangles that resulted from the triangulation are checked for intersections. If intersections are found, an error message is issued and how many triangles were found to intersect is posted in the numeric field.

Preview...: Clicking on this button invokes a preview dialog where a wire frame display of the model is shown. If any of the **Scale**, **Use Current Reference Plane As Base Plane**, or **Position In Positive XYZ Octant** options are selected, the model is shown with the respective transformations applied. The overall dimensions and the minimum and maximum coordinates of the model are also drawn. The exported objects are drawn in black while the support structures are shown in the highlight color. The preview dialog includes tools for manipulating the view parameters of the display.

Requirements and recommendations

Before exporting to STL files, you should carefully review the instructions of the manufacturer of the rapid prototyping machine you will be using and follow their recommendations. As an example, following are the requirements and recommendations for STL files intended to be used with a Stereo Lithography Apparatus (SLA), manufactured by 3D Systems, Inc., of Valencia, California. The SLA machines use a liquid polymer that is cured by the exposure to a laser beam.

About the model:

- The minimum recommended wall thickness is 0.02 inches (0.5 millimeters).
- The model must reside entirely in the positive XYZ octant.
- The distance between the model and the origin should be minimized.
- The height of the model should be minimized, by selecting the most efficient slicing direction. This reduces the number of layers required to be built, which reduces the construction time.
- The number of enclosed volumes (cavities) should be minimized.
- The number of sloped surfaces should be minimized. Such surfaces tend to result in a stair-step appearance, with the thickness of each layer being the height of the step. Special effort should be made to orient the most important surfaces vertically or horizontally.
- The part must fit in the tank holding the liquid polymer. Large models can be built in parts through several runs and assembled after they are constructed.

About the support structure:

- The supports should be located in a manner that provides a rigid foundation for the model. This includes supporting corners and edges. The model should be separated from the machine platform by support structures.
- Bottom and side supports should overlap the model by 2 to 3 layers (0.04 to 0.06 inches). This ensures a strong bond between the supports and the model.
- Diagonal supports beginning and ending on the part should be designed as buttresses rather than extending into a corner of the model, where they are hard to remove.
- Supports typically are spaced 0.1 to 0.8 inches apart. In general, they must be located at sufficiently close intervals so that no appreciable sag or curl occurs.
- The supports must be at least 0.65 inches long where they contact the platform to span platform drain holes.

Trimble SketchUp

This file format is only available for importing and is used for bringing into **form•Z** models from SketchUp. Note however, that not all SketchUp models can come into **form•Z** as solid models. **form•Z** will do its best to convert the information imported from SketchUp to solids, but it is not always successful due to the fact that some objects may be incompletely enclosed.

The Trimble SketchUp files use the extension ".skp."

To import a SketchUp file invoke the **Modeling Import Options: SketchUp** dialog, which is a standard import dialog. That is, it only contains general type of options and has no SketchUp specific options. In this dialog, the **Import Textures** option is on by default.

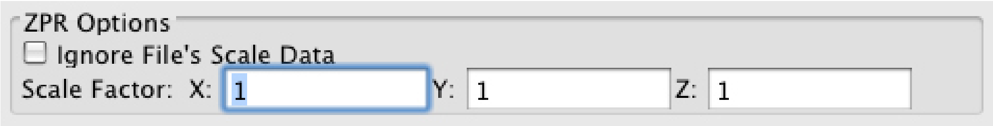
ZPR

ZPR is a file format that is used by 3D printers from Z Corporation (www.zcorp.com). 3D prints are made by spreading a thin layer of powder on the print bed. Then, using inkjet printer technology, a binder is “printed” on the powder which solidifies the powder. This printing process is done one cross-section at a time until the full 3D model is printed. To print a **form•Z** model, the model is exported as a ZPR file. The exported file is then loaded into Z Corporation’s Zprint software which drives the printer.

This process imposes many of the same restrictions as any other rapid prototyping process. The model must be described by one or more closed volumes. Independent surfaces are not allowed. Overlapping or intersecting volumes are allowed but in some cases may result in anomalies in the printed model. To avoid any anomalies, volumes should intersect at facetted face edges. ZPR files only contain triangular faces; consequently, **form•Z** decomposes all the faces of an object before the object is exported. The maximum size of the exported model is limited by the specific printer model to be used. Unlike STL, supporting structures are not needed in ZPR files. Z Corporation's Zprint software will add these.

Importing ZPR Files

A ZPR file is imported into **form•Z** in the standard manner. The **Modeling Import Options: ZPR** dialog contains two format specific options, in addition to the common options.



ZPR Options
☐ Ignore File's Scale Data
Scale Factor: X: 1 Y: 1 Z: 1

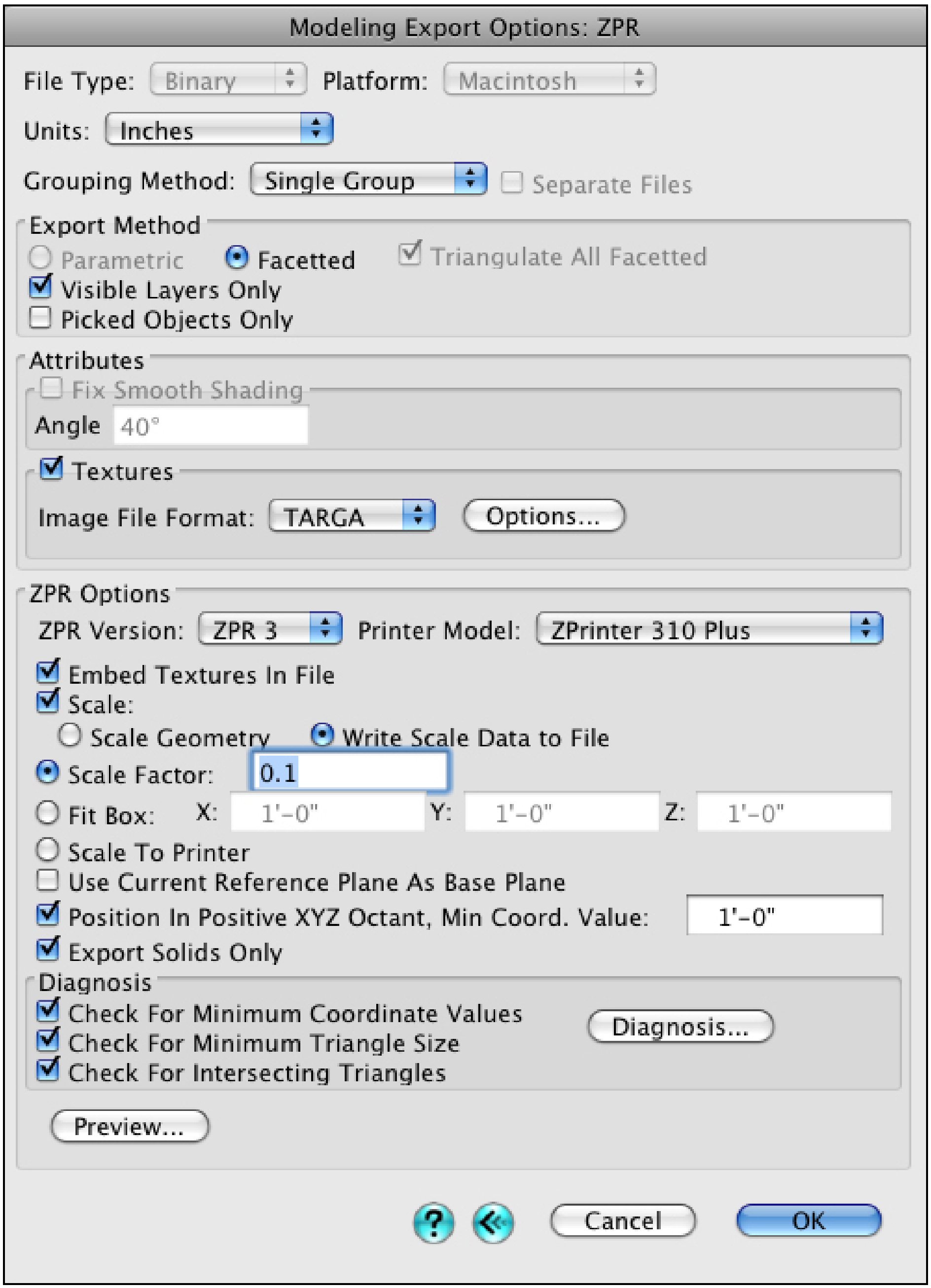
The Modeling Export Options: ZPR dialog.

Ignore File’s Scale Data: ZPR files contain a transform which scales (and can also rotate and translate) all geometry in the file. This allows original model vertex coordinates to be preserved while transforming the model to fit within the physical limits of the printer. Normally when a ZPR file is imported into **form•Z**, the geometry is transformed as specified by the file. When this option is selected, the geometry will not be transformed and the original vertex coordinates will be imported.

Scale Factor: X, Y, Z: The scale factors entered in these fields are applied to the geometry in addition to the file’s transform (unless **Ignore File’s Scale Data** is selected). If no scaling is needed, these values should be kept to 1.0, which are the default values.

Exporting ZPR Files

The content of a **form•Z** project is exported as a ZPR file in the standard manner. When exporting to ZPR, the active window must be a modeling window, as drafting elements can not be exported to ZPR. The desired options are set in the **Modeling Export Options: ZPR** dialog, which contains a number of format specific options.


Modeling Export Options: ZPR

File Type: Binary Platform: Macintosh

Units: Inches

Grouping Method: Single Group ☐ Separate Files

Export Method

○ Parametric ● Facetted ☑ Triangulate All Facetted

☑ Visible Layers Only

☐ Picked Objects Only

Attributes

☐ Fix Smooth Shading

Angle 40°

☑ Textures

Image File Format: TARGA

ZPR Options

ZPR Version: ZPR 3 Printer Model: ZPrinter 310 Plus

☑ Embed Textures In File

☑ Scale:

○ Scale Geometry ● Write Scale Data to File

● Scale Factor: 0.1

○ Fit Box: X: 1'-0" Y: 1'-0" Z: 1'-0"

○ Scale To Printer

☐ Use Current Reference Plane As Base Plane

☑ Position In Positive XYZ Octant, Min Coord. Value: 1'-0"

☑ Export Solids Only

Diagnosis

☑ Check For Minimum Coordinate Values

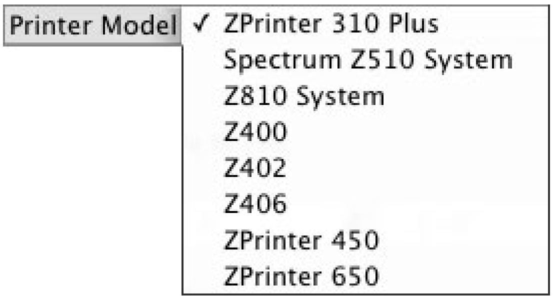
☑ Check For Minimum Triangle Size

☑ Check For Intersecting Triangles

The ZPR specific export options.

ZPR Version: The version of the format can be selected from this pop up menu. ZPR v. 3 and later contain a specification for the type of units used in the file (**Metric** or **English**). Version 2 files do not have this information, thus when version 2 files are opened, the **ZPR File Units** dialog is invoked for telling **form•Z** what units the ZPR data is in. Select **Inches**, **Feet**, **Centimeters**, or **Meters** and click OK.

Printer Model: A printer model can be selected from this pop up menu. This information is used to determine the size of the printer bed and may cause the model to be sectioned into several zpr files. Known printer models are listed in the menu.



The Printer Model menu.

Embed Textures In File: When this option is selected, the model's textures are embedded (contained) in the exported ZPR file. This can result in larger ZPR files, however, it has the advantage that all of the information necessary to print the model is contained in a single file. When this option is not selected, the textures are kept in separate texture files. The location and format of these is controlled by the options in the **Textures** section above. The **Embed Textures In File** option is enabled and is on by default when ZPR version 3 (or later) is selected. This option can not be disabled when exporting ZPR version 2 files as this version only supports embedded textures.

Scale: Models printed on Z Corporation printers are limited to a certain size, which may make it necessary to scale the model when it is exported. This can be done by selecting the **Scale** option and entering the appropriate scaling parameters.

> **Scale Geometry**: ZPR files contain a transform which scales (and can also rotate and translate) all geometry in the file. This allows original model vertex coordinates to be preserved while transforming the model to fit within the physical limits of the printer. When this option is selected, this transform is set to unity and the geometry of the model is scaled.
>
> **Write Scale Data To File**: When this option is selected, the scale data defined here is written to the ZPR transform and original vertex coordinates are exported.
>
> **Scale Factor**: When this option is selected, the scale factor contained in its field will be uniformly applied in all directions to the model.
>
> **Fit Box**: When this option is selected, the model is scaled to fit in a bounding box whose size is determined by the numeric values contained in the X, Y, and Z fields.
>
> **Scale To Printer**: When this option is selected, the model is scaled to fit within the printer bed as specified by the printer chosen in the **Printer Model** menu. When this option is selected, the model will not be split up and will be exported as a single ZPR file.
>
> **Use Current Reference Plane As Base Plane**: When this option is selected, the model is rotated so that the current reference plane is aligned with the print bed. Layers of the printed cross-sections will be parallel to this plane.
>
> **Position In Positive XYZ Octant**: When this option is selected the model is translated such that all it’s coordinates take on positive values and no coordinate value is less than that specified in the Min. Coord. Value field.
>
> **Export Solids Only**: When this option is selected (the default), only solid objects are exported.

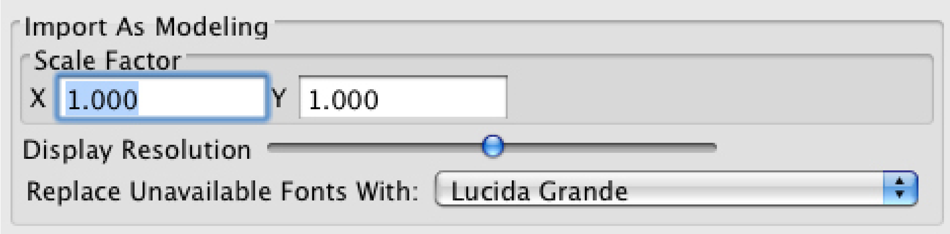
The **Diagnosis** and **Preview** options are identical to STL.

Importing and Exporting Image File Formats

In addition to the object formats, **form•Z** includes the ability to import and export several image formats, namely, BMP, EPS, Illustrator, JPEG, PNG, QuickTime Image, Targa, and TIFF. Additional image formats may be available through QuickTime. The dialogs invoked when image files are imported or exported have been structured as uniformly as possible so that switching from one format to another should not require extensive adjustments. Like the object formats, the image file formats also share a number of identical import and export options and therefore their dialogs share a common format.

Common image import options

The dialogs invoked when opening or importing image files into **form•Z** have been structured consistently, as they share many common options. These common options are in the upper section of the dialog, while the lower section contains options specific to that format. When an option does not apply to a format, it is dimmed.



Import As Modeling

Scale Factor

X 1.000 Y 1.000

Display Resolution

Replace Unavailable Fonts With: Lucida Grande

The common image file format import options.

Import As Modeling: This group of items controls how vector based images are imported.

Scale Factor: This group of items determines the X and Y scale that is applied to the vector image data when it is imported. The default is 1.0.

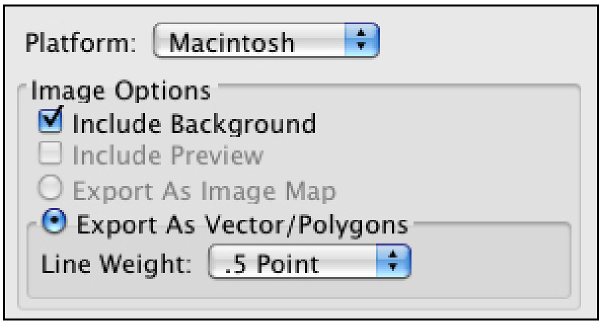
Display Resolution: This option sets the display resolution of imported smooth objects.

Replace Unavailable Fonts With: This is a menu that lists available fonts on the system **form•Z** is running on. If a file to be imported references a font that is not available, the font selected from this menu will be used as a substitute.

Common image export options

The dialogs invoked for exporting image files also share common options, which are at their upper portion. The lower section contains format specific options. When an option does not apply to a certain format, it appears dimmed.

Platform: File formats that are exclusively ASCII always have the **Platform** pop up menu available. Selection of one of these options produces text files with line terminations that are acceptable by Apple's Macintosh, DOS, or Windows, and UNIX computers respectively. Binary file formats that can be exported optimized for different platforms (i.e. TIFF) have this pop up menu available too.



Platform: Macintosh

Image Options

☑ Include Background

☐ Include Preview

○ Export As Image Map

● Export As Vector/Polygons

Line Weight: .5 Point

The common image file format export options.

Image Options: This group contains options that affect the export of images.

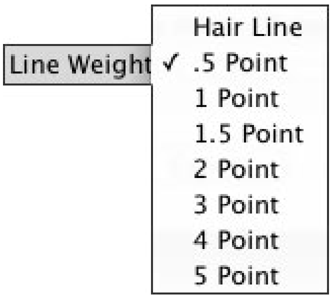
Include Background: If the current scene is exported as vector data, selecting this check box includes the background in the file. The background is a filled rectangle placed behind the entities shown on the screen. When this option is off, vector lines are exported without a background. In other words, deselecting this option exports the scene with a transparent background, which is desirable when a file is intended to be included on top of some other image. Note that pixel images always include the background when exported.

Include Preview: When this is on, a pixel based representation of the saved scene is included in the file. This image may be displayed as a preview of the content of a file, when the file is included by another application. This option is on by default for the formats that support it.

Export As Image Map: If this option is selected, the file is exported as a bitmap file.

Export As Vector/Polygons: If this option is selected, the file is exported as vector lines.

Line Weight: If the current scene is exported as vector data, all lines are assigned the line weight indicated in the pop up menu. The **Hair Line** option generates lines at the smallest resolution which a format can support. All other line weight options generate lines at the indicated thickness in points. One point is equal to 1/72 of an inch. The default is set to 0.5 point.



The Line Weight menu.

BMP

BMP is the standard bitmap image format for MS-DOS and Windows applications. It is an exclusively pixel based format similar to TIFF and Targa.

Exporting BMP files

The **form•Z** image displayed in the current window is exported as a BMP file in the standard manner, which is by using the **Export Image** command of the File menu. BMP files will always export the image displayed on the window.

DXF

DXF (Drawing Interchange Format) is the format in which AutoCAD® saves and exports its drawings.

Recall that this format can be used to transport 3D models. It can also be used to transfer 2D CAD data. Such data can be exported as a vector image from vector based renderers like hidden line. This is useful for exporting line drawings to drafting programs.

Exporting DXF files

The content of a **form•Z** window is exported as a DXF file in the standard manner. There are no DXF export options.

DWG

DWG is the native format of AutoCAD®. Similarly to DXF, this format is rather extensively used to transport 3D models. It is also used to transport 2D CAD drawings, which is why it is also included with the image file formats.

EPS

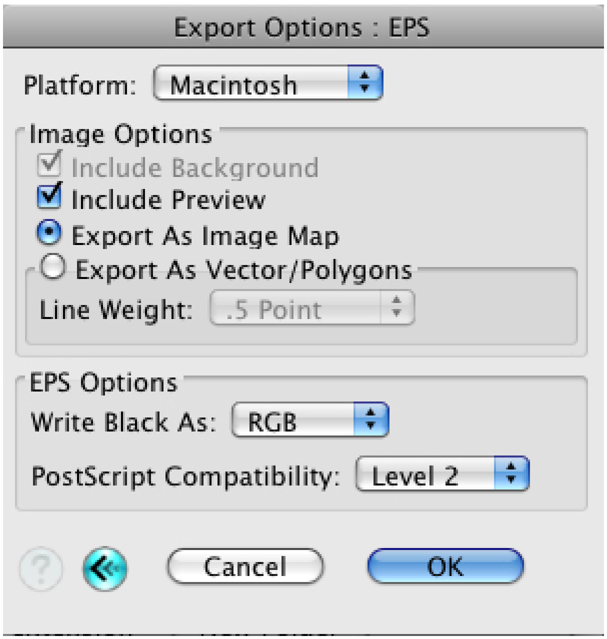
An EPS (encapsulated PostScript™) file contains PostScript language commands which describe the appearance of a single page. The commands in an EPS file generate 2D graphic information in the form of text, vector graphics and pixel images. Vector shapes may be lines, arcs or bezier curves. Connected paths can be constructed using those basic shapes. Paths can be drawn with different line styles and line thicknesses. Closed paths may be filled with a solid color or predefined patterns. Typically, the purpose of an EPS file is to be included, or "encapsulated," in another document. That is, when an EPS file is included in a document, the content of the EPS file is not interpreted and translated to the graphic format of the including document, but a direct copy of the commands in the EPS file is included. When the document is printed on a PostScript compatible output device, such as a PostScript Laser Printer, the encapsulated PostScript commands are executed by the device and they will generate the graphic information as it is described in the initial EPS file. EPS files may contain a preview image. A document including the EPS file is able to show the content of the EPS file by displaying the preview image. However, the final content of the included EPS file usually cannot be revealed until the document is printed.

Exporting EPS files

The content of a **form•Z** window is exported as an EPS file by executing the **Export Image** command (File menu), which invokes the **Save** dialog and then the **Export Options: EPS** dialog. This dialog contains a few format specific options.

Saving as an EPS file exports the content of the active window. When a modeling window is active, the 2D image displayed on the screen is exported, rather than the 3D representation of the modeling objects. How the exported image is represented in the EPS file (vector or pixel data) depends on the type of display that is on the screen. Hidden line images are exported as vector lines. Other renderings are exported as pixel images.

When a modeling scene is exported as vector lines, the line thickness is determined by the active **Line Weight** option in the pull down menu of the **Export Options: EPS** dialog. All lines are exported as solid lines.



Export Options : EPS

Platform: Macintosh

Image Options

☑ Include Background

☑ Include Preview

● Export As Image Map

○ Export As Vector/Polygons

Line Weight: .5 Point

EPS Options

Write Black As: RGB

PostScript Compatibility: Level 2

The Export Options: EPS dialog.

When a modeling scene is exported as pixel data, the maximum number of colors in the pixel image is determined by the **Image Color Depth** selected in the **Image Options** dialog, invoked from the **Display** menu. For example, if **8 bit (256)** is selected in the **Image Options** dialog, the pixel image can contain up to 256 different color values. When a scene is exported as vector data, the color information of an entity exported to an EPS file is determined by the red, green and blue values of the color attribute of the respective object, face or drafting element, regardless of the current **Image Color Depth** setting.

The modeling underlays that are produced from image formats cannot be described by EPS commands. Therefore, these entities are not included in the graphic information of an EPS file.

Write Black As: One of the three available items can be selected from this pull down menu:

> **RGB**: When this item is selected, black is exported as red=o, green=0, and blue=0.
>
> **Gray**: When this item is selected, black is exported as gray=0.
>
> **CMYK**: When this item is selected, black is exported as cyan=0, magenta=0, yellow=0, and black=1. This option is only available when PostScript Compatibility is set to Level 2.

Which option is selected may be significant when producing plates for color printing and black need to be generated as a spot color. In such cases, the **CMYK** and **Gray** options usually work best.

Postscript™ Compatibility: When the **Level 1** option is selected, the EPS file can be printed on a Postscript device which only supports Postscript Level 1. Postscript Level 1 does not support color images and hatch patterns. Level 1 files are supported by Level 2 devices but Level 2 files cannot be printed on Level 1 machines. The default option is set to **Level 2**.

Illustrator

Adobe Illustrator™ is a 2D drawing and page designing program. Users of the program can generate open and closed paths and add text. Paths are defined by a series of connected segments. Each segment can be a straight line or a curved Bezier segment. Paths can be filled with a solid color or a pattern. Text elements in Illustrator can be placed at a point, inside a path, or along a path. The Illustrator file format describes the geometry and attributes of all paths and text elements in a PostScript® language page description. When imported into **form•Z**, the PostScript commands contained in the Illustrator file are interpreted and modeling objects are generated. Currently, **form•Z** imports Illustrator files versions 3 to 8, and exports Illustrator files version 3.

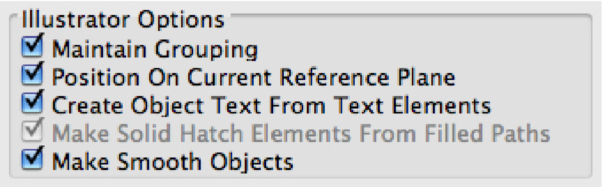
Illustrator paths can be composed of straight line segments and curved Bezier segments. When imported into the modeling environment, an Illustrator path is created as a composite curve.

Given the 2D character of the Illustrator file format and the 3D nature of the **form•Z** modeling structures, only 2D images of modeling scenes can be exported from the modeling environment and only surface objects can be imported into it.

As a comprehensive page design program, Illustrator offers a great variety of text attributes. Some of those attributes are not supported in **form•Z**, since they exceed the scope of a modeling program. When text elements are imported, those attributes are ignored for the generation of **form•Z** text. In addition, Illustrator text is stored both in a parametric form and in a final form, the latter of which is displayed on the screen. Since **form•Z** does not support several of the Illustrator text parameters, the final form representation of the text is used when importing. That is, all parts of a text element which share the same attributes are generated as separate **form•Z** entities. Illustrator also offers text which follows the shape of a path or fills the area of a path. When imported into **form•Z**, each part of the text which bends at a corner of a path or wraps to a new line will be generated as a separate text object in **form•Z**.

Importing Illustrator files

An Illustrator file is imported into the modeling environment of **form•Z** in the standard manner. The **Import Options: Illustrator** dialog contains some of the common options and a few format specific options, as follows:



Illustrator Options
- ☑ Maintain Grouping
- ☑ Position On Current Reference Plane
- ☑ Create Object Text From Text Elements
- ☑ Make Solid Hatch Elements From Filled Paths
- ☑ Make Smooth Objects

The Import Options: Illustrator dialog.

Maintain Grouping: This option is only available when importing into a modeling project. When selected, the elements grouped in the Illustrator file will be grouped when imported into **form•Z**. Otherwise no groups will be generated.

Position On Current Reference Plane: With this option the 2D data in the Illustrator file will be placed on the current reference plane, which may even be an arbitrary plane. When this option is off, the Illustrator data is placed on the world XY plane.

Create Object Text From Text Elements: When this option is on text objects are created from the text elements contained in the imported Illustrator file.

Make Smooth Objects: When this option is on, which is the default, curves will be imported as smooth objects. Selecting this option for large files can greatly increase the import time. When this option is off, all entities will be imported as facetted.

Exporting Illustrator files

The content of a **form•Z** window is exported as an Illustrator file in the standard manner. The **Export Options: Illustrator** dialog only contains common options.

Saving an Illustrator file exports the content of the active window. When a modeling window is active, the 2D image which is currently displayed on the screen is exported, rather than the 3D representation of the modeling objects. However, since Adobe Illustrator does not support pixel images, pixel based renderings cannot be exported.

JPEG

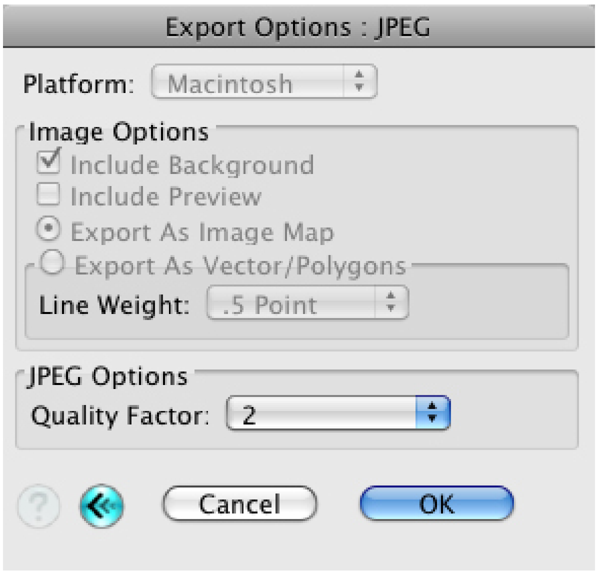
The Joint Photographic Experts Group (JPEG) format is commonly used to display photographs and other continuous-tone images over the Internet. JPEG files retain all their color information in an RGB image and also use a compression scheme that effectively reduces file size by identifying and discarding nonessential image display data.

Because it discards data, the JPEG compression scheme is referred to as "lossy." Once an image has been compressed and then decompressed, it will not be identical to the original image. A high level of compression will result in lower image quality, while low compression levels result in higher quality images.

Exporting JPEG files

The content of a **form•Z** window is exported as a JPEG file in the standard manner. The **Export Options: JPEG** dialog, in addition to the common options contains one format specific option.

Quality Factor: The items in this pop up menu specify which JPEG compression scheme will be used when exporting. Selecting the maximum quality setting, **5 (High)**, will produce the best image, but will result in a larger file size. Selecting the lowest setting, **1 (Medium)**, will produce the lower quality image, but will result in a smaller file size. The default setting is **2**.



Platform: Macintosh

Image Options

☑ Include Background

☐ Include Preview

● Export As Image Map

○ Export As Vector/Polygons

Line Weight: .5 Point

JPEG Options

Quality Factor: 2

The JPEG export options.

PNG

The Portable Network Graphics (.png) image format is a generic cross platform format designed to be compact and transmit quickly across networks and the Internet. It is fully supported in **form•Z** as all other pixel based image formats (TIFF, TARGA, BMP). PNG images can be used as texture maps and can be viewed using the **View File** menu item in the **File** menu.

Exporting PNG files

The graphics in a **form•Z** window can be exported in PNG format in the standard manner. The **Export Options: PNG** dialog only contains common options.

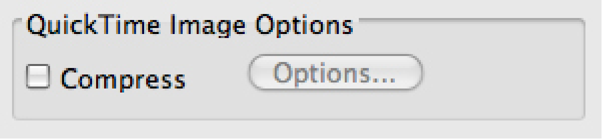
QuickTime™ Image

QuickTime™ supports a single frame QuickTime™ Image format as well as additional formats through component plug-ins. **form•Z** can import and export the QuickTime™ Image format as well as any format that is supported through the available Apple or third party QuickTime™ plug-ins. This format is not available when QuickTime™ is not installed.

The minimum version of QuickTime™ supported is QuickTime™ 2.5 for Macintosh and 3.0 for Windows. It is recommended to use the latest version of QuickTime™ available. Please visit www.QuickTime.com for details on the latest versions.

Exporting QuickTime Image files

The content of a **form•Z** window is exported as a QuickTime™ Image file in the standard manner. The **Export Options: QuickTime™ Images** dialog contains both common and format specific options.


QuickTime Image Options

☐ Compress

The **QuickTime™** Image export options.

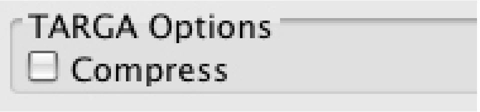
Compress: When this option is selected, the image will be compressed using the standard QuickTime™ compression options which are accessed from the adjacent **Options...** button.

QuickTime™ plugin components may add formats to the **Export Image** submenu of the **File** menu. These formats can be identified by the string "(via QuickTime™)" written next to the format name. If one of these items is selected at export time, the data to be exported is sent to QuickTime™ which produces the export file.

TARGA

The Targa (TGA) file format is commonly supported by MS-DOS and Windows color applications. It is a pixel based format similar to TIFF. It is available on both Windows and Macintosh versions of **form•Z**.

Exporting Targa files



TARGA Options

☐ Compress

The **TARGA specific** export options.

The **form•Z** image displayed in the current window is exported as a Targa file in the standard manner. The **Export Options: TARGA** dialog, in addition to the common export options, contains a format specific option.

Compress: Selecting this item causes the Targa file to be run length encoded, which results in a smaller size without losing any image information. Targa files will always export the image displayed on the window (which can be a modeling or a drafting window) and they are always written as 24 bit color pixel images.

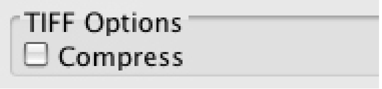
TIFF

The Tagged-Image File Format (TIFF) is a pixel based format, used to exchange image documents between different applications and different computer platforms. Typically, in applications that support TIFF, the scene currently displayed on the screen is saved into a TIFF file. Each screen pixel is saved with the color information as shown on the screen. TIFF files can be quite large. To keep their size reasonable, there is an option for compressing them.

Exporting TIFF files

The contents of a **form•Z** window are exported into a TIFF file in the standard manner. The **Export Options: TIFF** dialog contains common options and one format specific option.

Compress: When this option is selected, the TIFF file is compressed to the smallest size possible without losing any image information.



TIFF Options

☐ Compress

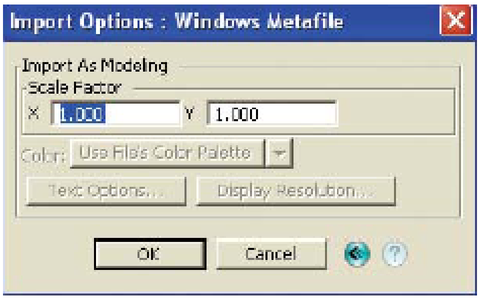
The **TIFF specific** export options.

Windows Metafile

The Metafile format is a Windows standard, where it is used for exchanging graphic information between applications. A Metafile is a collection of 2D integer based Windows drawing commands. A Metafile image may contain vector graphics, such as lines, rectangles, and polygons, as well as bitmap or pixelmap images. The Metafile format is analogous to the PICT file format for the Macintosh computers and all the options available in its import and export dialogs work as for PICT files. The Metafile format is only available on Windows.

Importing Metafile files

The content of a Metafile is imported into **form•Z** in the standard manner. The **Import Options: Windows Metafile** dialog contains common options only. Note that Metafile images can also be imported as underlays and image maps.


Import Options : Windows Metafile

Import As Modeling

Scale Factor

X 1.000 Y 1.000

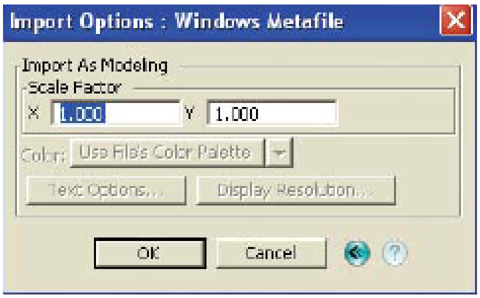
Color: Use File's Color Palette

The Windows Metafile Import options.

Exporting Metafile files

The content of a **form•Z** window is exported as a Metafile file in the standard manner. The **Export Options: Windows Metafile** dialog contains common options only. Saving as Metafile exports the content of the active window, which may be a modeling or a drafting window.

When a modeling window is active, the 2D images currently displayed on the screen are exported, rather than representations of the modeling objects. How the exported images are represented in the Metafile format (vector lines or bit/pixel maps) depends on the type of display that is currently on the screen. **Shaded** render, and **RenderZone** renderings are exported as bit maps. **Wire frame** and **Hidden line**, may be exported as vector or bit map representations.


Import Options : Windows Metafile

Import As Modeling

Scale Factor

X 1.000 Y 1.000

Color: Use File's Color Palette

The Windows Metafile Export options.